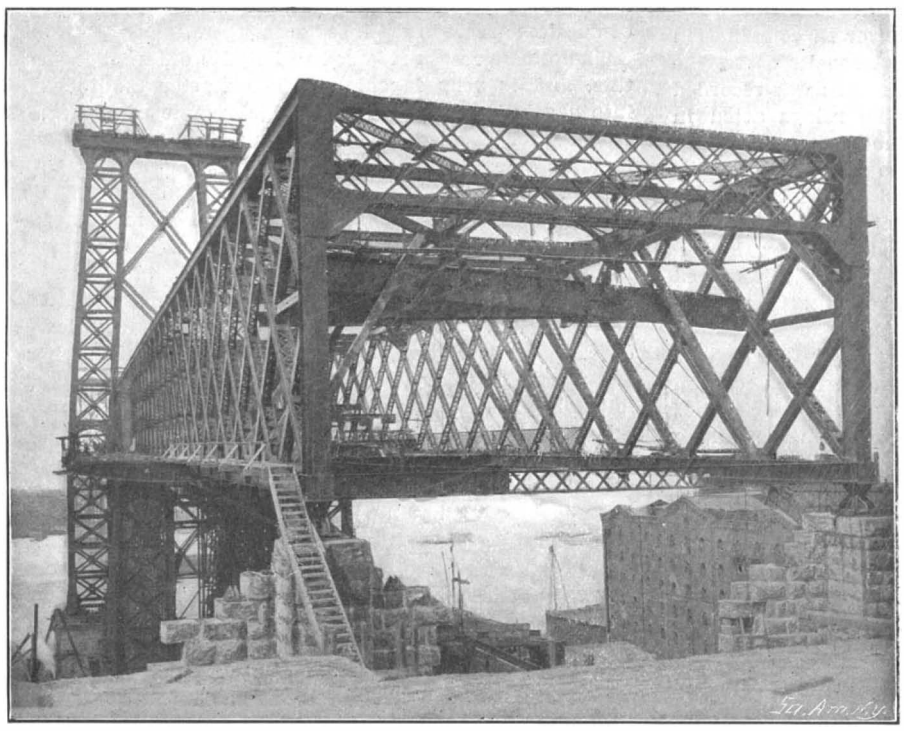
SCIENTIFIC AMERICAN

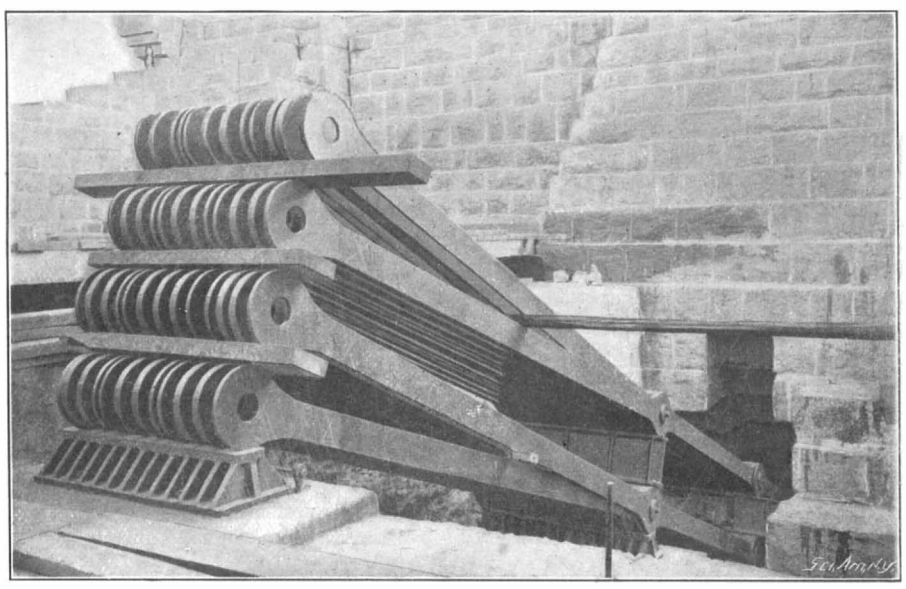
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1901, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

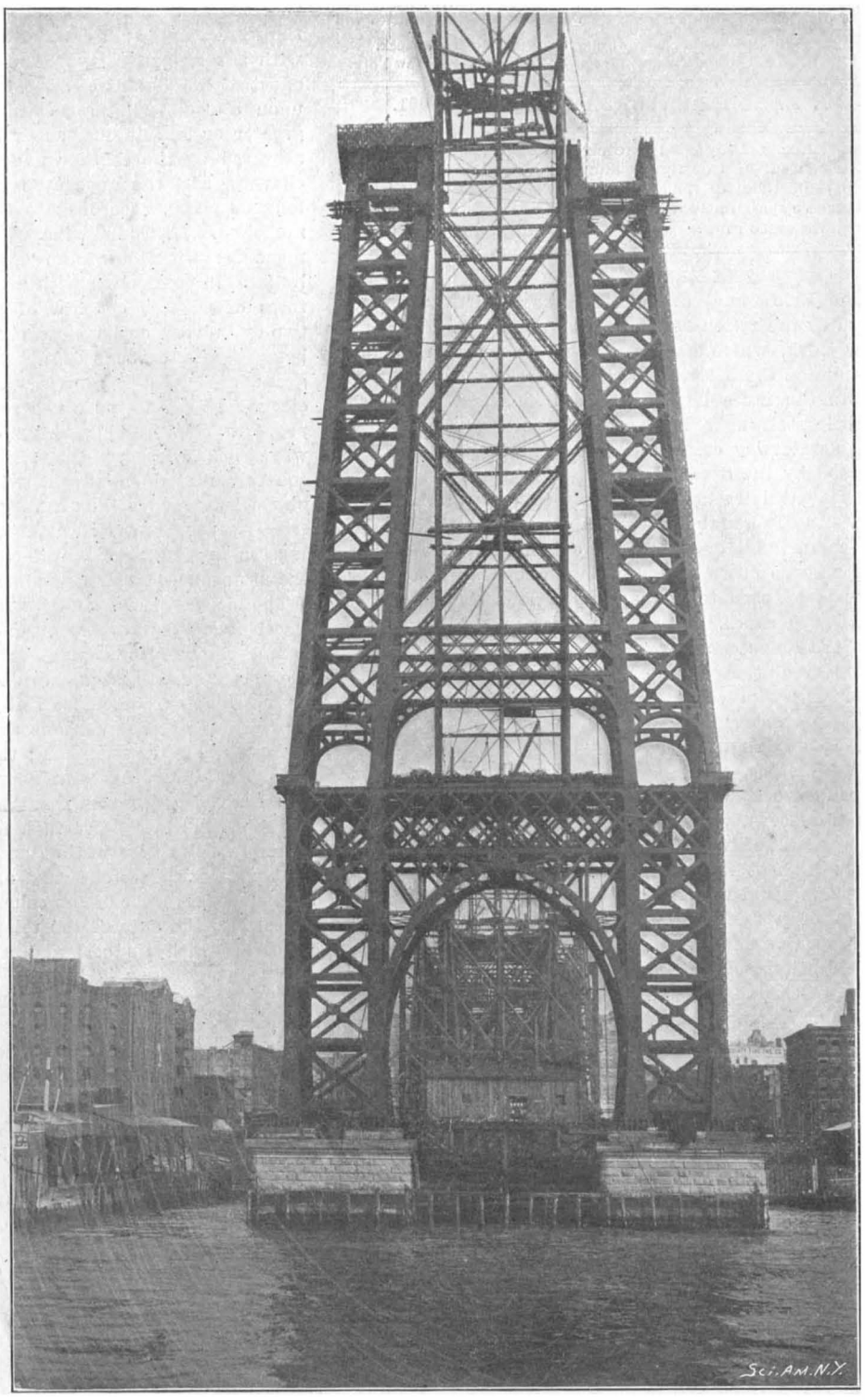
Vol. LXXXIV.—No. 16. ESTABLISHED 1845. | NEW YORK, APRIL 20, 1901. | $3.00 A YEAR. 8 CENTS A COPY.



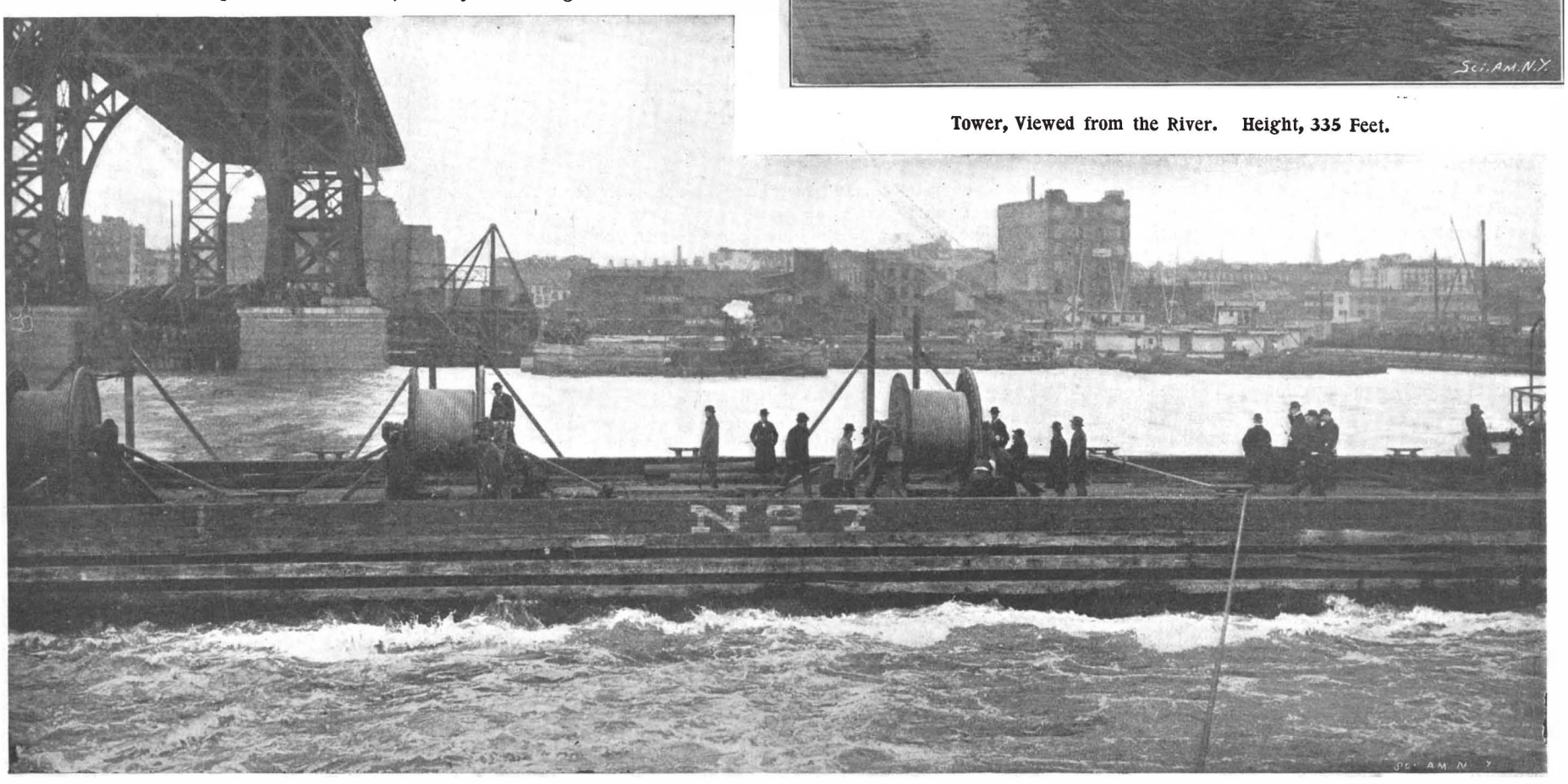
Shore Span from the Brooklyn Anchorage.



Group of Anchor Chains, Brooklyn Anchorage.



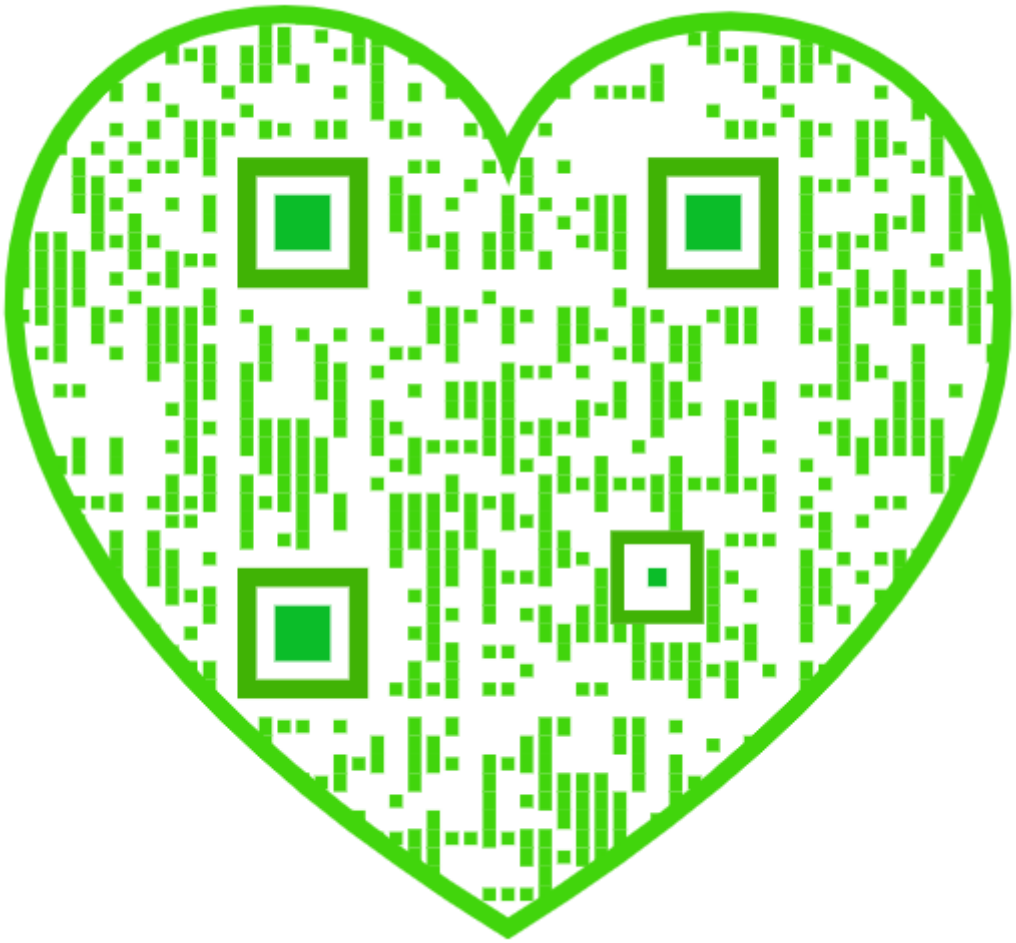
Tower, Viewed from the River. Height, 335 Feet.



Towing the Foot-Bridge Cables Across the East River, April 9, 1901

CONSTRUCTION OF THE NEW EAST RIVER BRIDGE.—[See page 246.]

© 1901 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, APRIL 20, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE ERIE CANAL MUDDLE.

The Erie Canal problem has been further complicated by the action of the Canal Association of Greater New York, which has emphatically and unanimously repudiated the $26,000,000 canal improvement bill now before the State Legislature, and has declared itself as being strongly in favor of the 12-foot 1,000-ton barge waterway costing $62,000,000, which was recommended by the expert commission of Governor Roosevelt's administration as the only solution of the problem. As the Canal Association comprises all the leading commercial organizations of this city, its resolution may be taken as indicating that the city of New York is opposed to any appropriations for the 9-foot $26,000,000 canal, or any improvement of less scope than the 12-foot waterway.

The resolution of the Canal Association produced something like consternation among the supporters of the present bill, for it looks as though this expression of opinion would prevent the passage of the bill and, therefore, prevent appropriations of any kind for canal work at this session. So far as we have been able to discern, very little, if anything, has been said of one aspect of the question—an aspect which is surely of the highest importance, seeing that it dominates the whole canal problem, irrespective of the particular merits of a 9-foot or a 12-foot reconstruction. We refer to the superior advantages, due to geographical location, offered by the powerful competitive route which exists in the system of canals and channel improvements known as the St. Lawrence River Canal system. Since the object of the Erie Canal improvement is to provide a cheap route from the Lakes to deep water, it is evident that the question of the quantity of tonnage which will seek this outlet will be determined by the question of its relative convenience compared with the northern route. As matters now stand, the least depth over the sills of the Canadian locks is 14 feet, which is 2 feet more than the least depth of the proposed 1,000-ton barge canal. Moreover, the aggregate length of the St. Lawrence canals is relatively insignificant compared to the total length of the Erie system, the canals in the former case being merely connecting links between the natural channels of the St. Lawrence River, which have been put in wherever the navigation is obstructed by rapids or waterfalls. We notice that in the report of the Green Commission to Governor Roosevelt, the approaching completion of the Canadian system was urged as one of the urgent reasons for improving the Erie canal, and in this connection it becomes a question for serious consideration as to how far the shorter length and greater capacity of the Canadian system will cause the east-bound grain to seek that outlet in preference to a canal of inferior accommodation through New York State. Probably the St. Lawrence Canal has now been in use long enough to determine what its effect will be upon the various rail and canal routes from the Great Lakes to New York. That it will divert a portion of the tonnage which has hitherto come to this city is to be expected, and upon the probability or improbability of a 1,000-ton barge canal being able to compete successfully with one that will allow of shipments direct from lake ports to Europe in deep-sea steamers, should depend very largely the question of the expediency or inexpediency of any canal improvements whatever, short of a full-sized ship canal.

The question of a ship canal is an attractive one until it is weighed in the balance of cold figures; for it must be confessed that the report of the United States engineers indicates that the total cost would be so great as to overbalance the prospective advantages to the State at large or to the city as a terminal point. At the same time, we think that a careful investigation of the results already obtained by the St. Lawrence Canal system, and a determination of its advantages of location, would render it possible to determine very closely what improvements would be necessary to place the Erie Canal at least on equal terms with its powerful northern competitor.

APPLICATION OF THE COHERER TO DETECTION OF STORMS.

M. Tommasina has recently discovered a new application of the coherer, that of detecting atmospheric electrical discharges or storms, even when these occur at great distances, and has devised an instrument for the purpose, which he calls the electro-radiophone. A description of this apparatus has been given in a paper presented to the Academie des Sciences. It is, however, to the Italian scientist, Prof. Boggio Lera, that the credit of constructing the first instrument of the kind belongs; by using a coherer in combination with a series of relays of different sensitiveness, the effect of the distant electrical discharges was recorded upon a registering apparatus. The relays acted in greater or less number according to the conductibility acquired by the coherer under the action of the discharges, and the apparatus traced a series of lines, long or short, according to the intensity of the phenomenon. M. Tommasina utilizes in his new instrument the principle of the "auto-decoherer" discovered by him, in connection with a telephone receiver. This form of coherer consists of a glass tube containing two cylindrical carbons, nearly touching in the center; between the carbons is a small quantity of carbon granules, and this combination, under the action of electric waves, forms a coherer which has the unique property of returning to its original state after the waves have ceased, without any external action. This coherer, placed in circuit with a battery and telephone receiver, is thus a very good detecter for electrical waves; and M. Tommasina has applied it with success in detecting far-off electrical disturbances of the atmosphere or distant storms.

The coherer used in this case is formed of two small arc-light carbons, of 0.16 inch diameter, fitting easily into a glass tube, and between which are placed small grains obtained by crushing a portion of the same carbon, these being well freed from dust. To the ends of the carbons are fixed platinum wires to form the outer terminals; the carbons and granules are dried by heating to redness in a flame. The space between the carbons is regulated for maximum sensitiveness, this being 0.04 inch for grains of 0.008 inch diameter; the tube is then sealed at the ends to prevent moisture from entering, as this causes variations in the sensitiveness of the coherer. The tube is placed parallel to the axis of the telephone receiver and put in series with its coil and a few cells of battery. When the receiver is held to the ear the coherer is horizontal and in the position for best action. In carrying out the experiments, this arrangement was used at the same time as the electric registering apparatus of Prof. Lera, and the experimenter states that during the time that the discharges of the distant storm were registered, he heard a corresponding series of sounds in the telephone, and the hearer has the illusion of being transported to the actual place of the storm and of listening directly to all its phases; he was thus enabled to hear and study the phenomena of storms when they were at such a distance that no trace was observed on the horizon. In one case he observed a storm twelve hours before it passed over Intra, in Italy, where he had installed his apparatus. Owing to its great simplicity and absence of regulation, there is no doubt that the "electro-radiophone" will render great service in detecting the approach of storms, especially on shipboard.

IMPROVED PROCESS OF DUPLICATING PHONOGRAPH RECORDS.

The commercial demand for phonograph records for amusement purposes amounts to several thousand records a day. It would not be practicable to supply such a demand if each record had to be made separately by singing or playing before a phonograph. For several years the practice has been to record each performance on from four to a dozen machines at once, the machines being arranged on racks or shelves with the horns converging toward the band or singer. The records thus made are called masters, and are copied in duplicating machines, which work somewhat on the principle of a pattern lathe. Two mandrels rotate side by side, one bearing the master record and the other a blank on which it is to be copied. A reproducer stylus rubbing over the master guides a recording stylus which cuts the duplicate record in the blank. By this method a number of duplicates are made from each master, but after a while the master shows signs of wear, and the duplicates produced are not of good quality. Ordinarily about twenty good duplicates can be made from one master before the latter is condemned.

As many of these masters require a whole band of music to make them, they are expensive, and it is very desirable to have a method of producing a larger number of duplicates from a single master. Two successful solutions of this problem have recently been perfected.

By the first method an electrotype mold is made by first depositing over the master an exceedingly thin coating of metal by Edison's process of vacuous deposit, electroplating, and backing up the copper plate with a stout backing of metal. Records are cast by introducing melted wax into the mold about a core. The mold is used cold, so as to chill the surface of the wax.

To remove the record from the mold advantage is taken of the facts that wax has a high coefficient of expansion, and that the record groove is very shallow, so that when the record is cooled it contracts more than the mold and is readily slipped out endways. The molds may be preserved indefinitely, and any number of duplicate records produced from them.

The other process referred to is quite different from this, and is very ingenious. The master is dipped into a solution of gelatine and bichromate of potash, which when dried and exposed for a time to the light remains as a thin, tough skin adhering closely to the record. This is coated with shellac, and afterward with a substantial backing of wax, which is turned true and pushed into a brass tube. When the master record is broken out, there remains on the interior of the composite cylinder thus produced a very faithful gelatine mold of the record. A one per cent solution of celluloid is flowed over the interior of this mold and permitted to dry, leaving a very thin skin of celluloid which is then coated with chromatized gelatine. Several alternate layers of celluloid and gelatine may be laid on in this mold until a skin of sufficient thickness is obtained, which is then strengthened by a suitable backing having in its center a hole properly tapered to fit the mandrel of the duplicating machine. The brass tube and the wax part of the mold are then removed and the gelatine matrix stripped from the celluloid, leaving a very perfect copy of the original record with a surface of celluloid.

This record is used as a master in the duplicating machine, and it shows no signs of wear even after many hundreds of wax duplicates have been made from it.

NEW PRODUCTS IN THE GLASS INDUSTRY.

M. Léon Appert has lately read an interesting paper before the Société des Ingénieurs Civils, relating to the progress of the glass industry as shown at the Paris Exposition. After describing the different processes of manufacture, he mentions several new products which have been lately brought out. One of these is called glass stone by its inventor, M. Garchey. It has been found that when certain kinds of glass are cooled, then slowly reheated, that a kind of precipitation takes place in the mass. The inventor uses a glass rich in lime, such as bottle-glass, for this purpose. The glass, cooled to a point somewhat below fusion, is submitted to a temperature of 1,200 deg. C., and the plastic mass then undergoes a strong pressure by means of powerful hydraulic presses. The piece after it comes out of the press is annealed in the usual way. This product possesses remarkable qualities of hardness, inalterability and resistance to wear. It is more elastic than ordinary glass, and is thus much less fragile. Its properties render it well adapted for paving blocks or tiling, and it may be used to advantage on the outside of buildings. The author mentions also the "strengthened glass" which has come into use, this being a flat glass plate containing a metallic network in the center which renders it far superior to ordinary glass as regards solidity and resistance. In case of fire it will stand the highest temperature without bending. This glass may be obtained in two different ways. The French process, due to M. Appert, differs from the American, in which the rigid metal network is forced into the glass sheet; in the French process, two separate sheets of glass are rolled, and the network is introduced between them, the whole being pressed together in the rolls. Another glass which may be considered as new, although known for some years past, is that known as "opaline." This glass, of a milk-white or greenish hue, has come into use of late for tile-work, and it may in a great many cases replace ordinary tiles at a less cost. The underground stations of the Paris Metropolitan are entirely lined with these "opaline" tiles, which produce an agreeable effect. The St. Gobain glass works had an important exhibit of opaline glass at the Exposition. The author mentions also the perforated glass, which facilitates the ventilation of dwellings, and thus renders great service from a hygienic point of view. Plates of glass for buildings, roofs, etc., are now being made of very large size, up to 15 and 18 feet in length, and glass tubes are made as large as 20 inches in diameter.

NEW CHEMICAL COMPOUNDS.

Two new compounds have been recently formed in M. Moissan's laboratory by M. Tarible, who combines the bromide of boron with the two chlorides of phosphorus and obtains two well-defined crystalline bodies. The experiments are described in a paper read before

© 1901 SCIENTIFIC AMERICAN, INC.

the Académie des Sciences. The first of these compounds is formed by pouring bromide of boron upon the trichloride of phosphorus, PCl_3, contained in a test tube; the formation of a white crystalline compound is observed, and considerable heat is given off. The crystals were separated and dried, and upon analysis were found to correspond to the formula $PCl_3,2BoBr_3$, being a combination of the bromide of boron with the trichloride of phosphorus. This compound is colorless and crystalline, melting near 58 deg. C.; it sublimes partially at 40 deg. C. and decomposes before reaching its boiling point. It is soluble in both of the bodies which form it, and besides in carbon disulphide and chloroform; it is insoluble in vaseline oil. It fumes in the air, and water decomposes it rapidly, with production of heat and formation of hydrobromic, hydrochloric, phosphorous, and boric acids. In a current of hydrogen it sublimes near 30 deg. C., and decomposes partially beyond 50 deg.; it is attacked by oxygen at a red heat, but sulphur does not act upon it below its decomposing temperature. Ammonia gas is absorbed by it, with disengagement of heat and formation of a white crystalline compound. The organic compounds, ethers, alcohols and acids act energetically upon it. It dissolves easily in trichloride of phosphorus, and although the crystals obtained from the solution are not as fine as those from a bromide of boron solution, their formula is the same, and it is quite probable that this is the only combination formed at ordinary temperatures. The second body is formed in a similar way with the pentachloride of phosphorus, PCl_5; however, the bromide of boron and the pentachloride must be heated in a sealed tube to 150 deg. C. to give the reaction. In this case yellow crystals are seen to form, these being denser in appearance than those of the pentachloride; their composition is found to be $PCl_5,2BoBr_3$. This body, when pure, is colorless, the yellow color seen at first being probably due to the presence of chlorine. It melts near 151 deg. C., and then begins to decompose; it sublimes at about 100 deg. This compound is soluble in bromide of boron and carbon disulphide, but insoluble in vaseline oil. It fumes in moist air and water decomposes it rapidly, giving off the acids mentioned above; in a current of hydrogen it sublimes without decomposing; oxygen acts upon it at redness. Ammonia gas is absorbed by it, with great elevation of temperature, forming a white amorphous powder. The organic compounds and acids act upon this body as with the former. From a number of experiments it is probable that this compound is the only one formed under the circumstances.

LOCAL CONDITIONS FAVORABLE TO THE COTTON INDUSTRY OF THE SOUTH.

Nowhere has the development of cotton manufacturing been so rapid as in the South, and never before in the history of industries has such an increase in any one branch been recorded. In order to define the causes plainly, it is necessary to go back several decades. During the first years of the century, Virginia, the Carolinas and Georgia manufactured considerable cotton, but by degrees New England developed the industry at the expense of the South, while the civil war reduced the number of spindles in actual operation to less than 350,000 in this section. It may be said that the present industry in the Southern States had its birth in 1865 and has grown to its present proportions since that date, although but few mills were constructed until 1870. All of the machinery in use at the time of the war has long since been discarded, and for that matter much of the equipment which was running prior to 1890. Such has been the extent of the improvements made in mechanism for spinning and weaving.

It is hardly necessary to state that the water power and the extensive domestic market afforded near at hand stimulated the textile industry in New England until it assumed its present proportions. The abundant water power was also a reason for the revival of manufacturing in the South—but only one of several causes which have contributed to its growth. The climate, cheapness of fuel, proximity of the raw material, the abundance of labor as well as building material, also contributed to an important degree. The humidity of the Piedmont section of the South gives it an advantage which has caused a belt of these industries to be constructed in the Carolinas, Georgia and Alabama, although some mills are located in the lower country near the seacoast. The temperature is such that but for six or eight weeks out of the year is artificial heat needed to keep the mills at the proper degree of warmth. In fact, some of the plants are heated less than a month in the year, while the moisture in the atmosphere precludes the necessity of artificial means for supplying it, required in many other textile districts. The center of cotton production in the United States, not a few of the mills have been constructed in places where all of their supply is secured from the neighborhood, being brought to the door by wagon loads from the plantations. The purchasers are thus enabled to select the choicest lots for their purpose, and although the mill prices average from one-fourth to one-third of a cent per pound more than the amount paid by factors or agents of Northern and foreign consumers, the freight by rail and water saved on the raw material from the locality of the plant represents a percentage in its favor. The water power is abundant and capable of economical development in the Piedmont district, but while the machinery in a large number of the mills is operated by turbine plants, fuel is so cheap that auxiliary steam power comprises part of the equipment of most of the factories, to guard against the possible cessation of the water supply, temporarily or permanently. Both wood and coal are utilized, quite a few of the plants in the Carolinas still depending upon the first-named fuel, which is also purchased in the vicinity and much of it carried to the furnace doors on wagons. In Georgia and Alabama coal is more depended upon, and it is an actual fact that a part of the supply is delivered on the premises of the consumers as low as $1.50 per ton; while a company in Alabama located at Cordova controls mines from which the fuel is brought to its power house at a cost of about 90 cents per ton, including every item. It probably has the cheapest fuel supply of any textile industry in the world.

A large proportion of the population of the hill country of the South consists of white people who prior to the manufacturing era depended principally for a livelihood upon the few acres which each could till to raise food for themselves and fodder for their stock. Some gathered herbs which formed the basis for various medicines. The majority worked and lived under conditions of extreme destitution. With the building of the mills, an opportunity was offered not only the men, but the women, the boys and girls of ten years and older, to obtain steady employment, of which they have taken advantage. It is upon this class of labor that most of the manufacturers depend. Many of the large mill owners have secured the services of a superintendent and possibly two or three foremen proficient in weaving and spinning, and with the help of these experts have instructed the native whites in the work, in which they are becoming more and more adept. Compared with the English and New England spinners and weavers located where the industry is over a century old, they have not reached the standard attained by the Northern and foreign classes, but it is admitted that skill in producing finer yarns and cloths is only acquired after at least several decades of manufacturing, and the industry in the South is still in its infancy, so to speak, although the tendency has been of recent years to purchase more and more machinery adapted for spinning finer yarns and for manufacturing even such high grades of goods as cheviots, plaids, gingham, bedspreads, carpetings and damasks, in which fair success has been attained. As yet, however, the bulk of the product from the South consists of ducks, coarse cloths and heavy yarns. It might be stated here that although two or three experiments have been made with negroes as skilled laborers, thus far the results have not been successful, and in two instances mill owners have abandoned the idea. Colored labor, however, is utilized in handling the cotton, for "firing" the boilers and in other ways where purely mechanical ability is not required.

The low price of real estate in the South and its sparsely settled condition have given factory promoters an opportunity to secure sites at a very small price. In many cases land has been donated them by village or municipal corporations on account of the advantages which would accrue from the industry and the market it afforded for food, clothing and other supplies and the necessary demand for dwellings for the employes. Consequently the factories are not crowded together, and the great majority have been built on the outskirts of towns or in the open country, forming the nucleus of a community in themselves. Clay for brick making, timber for framework, even slate for roofing, can be procured throughout the cotton-manufacturing section, and most of the buildings have been erected by local mechanics under the supervision of a mill architect or engineer at a comparatively small cost, all of the material coming from near at hand with the exception of the machinery.

Some are upon navigable waters, giving them the benefit of obtaining not only supplies, but shipping their goods by vessel. The railroad companies, however, have been very liberal in constructing sidings to mills located on water powers and elsewhere at distances of from five to fifteen miles, for such sidings can be cheaply made of second-hand rails, thus enabling cars to be loaded directly at the doors of the mills without the extra expense for drayage and other transfer charges. The more important companies have found it profitable to purchase enough land to build the necessary dwellings for their employes, which they rent out at a price generally sufficient to pay for the outlay in a few years. In fact, an important item of the revenue of many of the companies comes from rental of their real estate. At the beginning of the activity in mill building, there was a tendency to use second-hand machinery exchanged by Northern mill owners for improved apparatus. This could be purchased at a much lower percentage than new equipment, and quite a number of mills constructed in the eighties were supplied with it, but several failures have been directly traced to the use of such equipment, and of late years Southern mill owners have been among the best customers of makers of standard textile machinery. In a later issue we shall treat of first cost and cost of operation of the Southern cotton mills.

SCIENCE NOTES.

Congress has appropriated the sum of $300,000 for the preservation of our forest lands. A regular force is to be established, the salary of each of whom is to be $3 per day, and $3 per diem for livery and traveling expenses. This is a practical step in the right direction.

A large hospital is being built in the Vosges Mountains for the isolation and treatment of lepers. In case whole families are attacked, small dwellings are provided for them. The treatment will be most scientific, and it is hoped that progress will be made in the cure of this terrible scourge.

An English signal operator kept an account of the various animals killed by the trains along the line where he was employed. His observation included three miles of track. He found cats, dogs, foxes, hares, rats, rabbits, a sheep, a cow, an adder, a hedgehog, a long-eared bat, hogs, rooks, besides other more familiar varieties of birds.

It is announced that on April 1 M. Curie, the chemist, separated a new gas from radium. It is intensely phosphorescent and will glow for months in the dark. It was also announced, says The New York Sun, who cabled over the news, that M. Naudon found means for producing X-rays without the aid of electricity by exposing a metal plate to the rays of the violet end of the spectrum.

The cold storage of furs, clothing, rugs, etc., is quite an industry in many of our larger cities. As the temperature is constantly kept below the freezing point, it is obvious that this is a perfect method of storing garments and furs when they are not required. They are removed from the racks free from the odor of tar, camphor, cedar, etc., and the furs are improved by hanging in the cold, dark, dry rooms. The wear and tear of frequent examination, beating, combing and brushing is avoided. The equipment of some of the plants is quite extensive.

In the majority of cases of the so-called arsenical poisoning by beer, the gravity of the symptoms has far exceeded those produced by any possible quantity of arsenic absorbed. This has been somewhat vaguely attributed to the formation of some biological organic compound of arsenic of a more intensely toxic nature than arsenic itself. It has been suggested that these symptoms indicate as a more probable cause the presence of selenium, which has been found in quite a considerable quantity, even in several forms of purified sulphuric acid. It is practically certain that any selenium in the acid would pass into glucose during the process of inversion.

Prof. W. P. Amalizki, of the Warsaw University, recently delivered a lecture at St. Petersburg relating to the discovery of his first skeleton in North Russia of an antediluvian race of giants, the Pariosaurus. The skeleton he unearthed measures nearly ten feet in length and is the largest fossil of this reptile that has ever been discovered. Hitherto the British Museum has possessed the largest specimen, found by Prof. Seeley in Cape Colony in 1889, and which measures over nine feet in length. Prof. Amalizki has been engaged in this quest for fossils for several months. He unearthed some thirty skeletons on the banks of the Northern Dwina, but they were in fragments, with the exception of this colossal specimen. The skeletons were found embedded firmly in a hard sandstone. They will be deposited in the Palæontological Museum, which is shortly to be built at St. Petersburg.

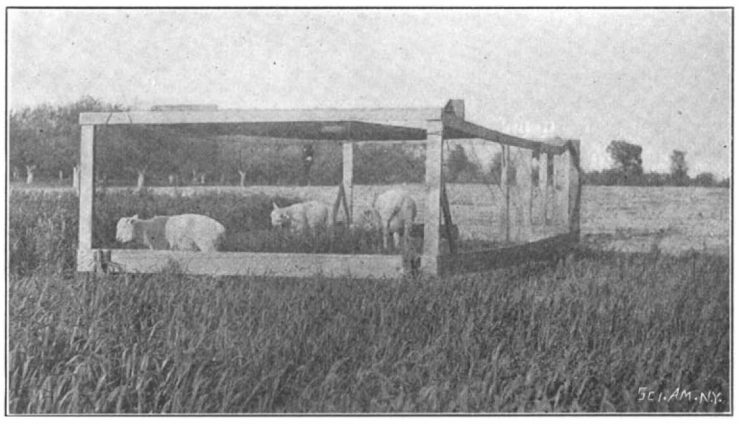
The investigation made by Prof. Beyer for the American Ornithological Association of the Louisiana Gulf Coast for the purpose of stationing wardens to protect the sea birds shows that action was not taken a moment too soon. Prof. Beyer found that nearly all the breeding places of the birds had been destroyed by killing the birds themselves and taking their eggs. Not a trace of birds was found on either Brush or Caillou Islands, at one time the home of millions of sea fowl. The same was true of Calumet and Castelle Islands, on which every living thing had been killed. A few gulls and hens were found left on Timbalier Island, and there are said to be a few on Last Island, which, however, could not be visited on account of the severe weather. Wardens were appointed wherever birds were found and the fishermen of the neighborhood promised to co-operate with the wardens in preventing the killing of the birds in the breeding season and the stealing of eggs.

© 1901 SCIENTIFIC AMERICAN, INC.

A MOVING, GRAZING PEN.

Mr. A. D. McNair, an agricultural expert, recently carried out some interesting experiments at the Michigan Agricultural College, Lansing, Mich. Having become acquainted with the remarkable productiveness and high feeding value of alfalfa, he conceived the idea of grazing it at the time when the stage of growth permitted of its having a maximum feeding value in such a manner that none of it would be tramped under foot. This stage is reached when the alfalfa is from one to two feet high. Mr. McNair proposes to construct bottomless pens mounted on wheels. After the sheep are admitted to the pen, the pen is drawn slowly across the field of alfalfa or other forage crop, so that the animals may eat all the approaching forage before they get their feet on it and trample it down. This system permits the forage to grow up behind ready for another grazing.

A practical experiment to demonstrate the value of the system was carried on at the Michigan Agricultural Experiment Station, at Lansing, and while it was on a small scale, at the same time it showed that the plan was perfectly feasible. Only a tenth of an acre of alfalfa was available for the purpose, so that only one grazing pen was required, and into it were put a Dorset ewe and her twin lambs. The pen was 16½ feet long and 8 feet wide. It was built of 2 x 4 inch bottom rails and corner posts, and 2 x 3 inch top rails, and braced with 1 x 3 inch pieces at each corner; poultry netting was used to inclose the whole pen. Caster wheels 8 inches in diameter were placed at each corner. Galvanized iron wires, No. 16, were attached to two corners of the pen and passed through swivel pulleys secured to stakes driven in the ground. They then passed around iron spools which were turned by an electric motor through the medium of gearing, pulley, and belt. The motor was a 1-10 horse power, 100-volt, single-phase, alternating-current motor, which was originally intended to operate a ventilating fan. It will be readily understood that a number of pens could be arranged in gangs and actuated by the same motor. The reduction of speed between the motor and the iron spools was in the ratio of 75,000 to 1, approximately. The movement of the pen was carried on first by hand until the electrical equipment could be gotten ready. The strip of alfalfa was a rod wide and 16 rods long, and this strip was to be grazed four times between May 1 and October 1. This meant a daily movement of 6.87 feet, and the area grazed was 113.35 square feet daily. Water was provided for the sheep, and a piece of rock salt was also supplied them. The pen was covered with canvas, serving as a protection against both rain and sun. The experiment was interesting, and the animals increased in weight, and had the lambs been butchered on August 1, the results would have been satisfactory, but after this date they sickened and died, showing that, while alfalfa is a very nutritious plant, animals need a variety of food. The electrical apparatus drew the pen about 2½ feet per hour, which was sufficient for the purpose. An effort was made to have the animals graze at regular times, as this would prevent their lying down against the side of the pen and blocking the motion, while, if they were accustomed to eating at regular intervals, they would get up at a signal and eat as the pen advanced. The electrical system of moving the pen seems to be commercially feasible, and it is immediately practicable along the lines of the electric railways which are now getting to be so numerous in the agricultural sections. Mr. McNair believes that a thousand pounds of flesh per acre of ground is by no means the limit that can be obtained by this means of grazing.



A MOVING SHEEP-FOLD OPERATED BY ELECTRICITY.

Arsenic in the Hair.

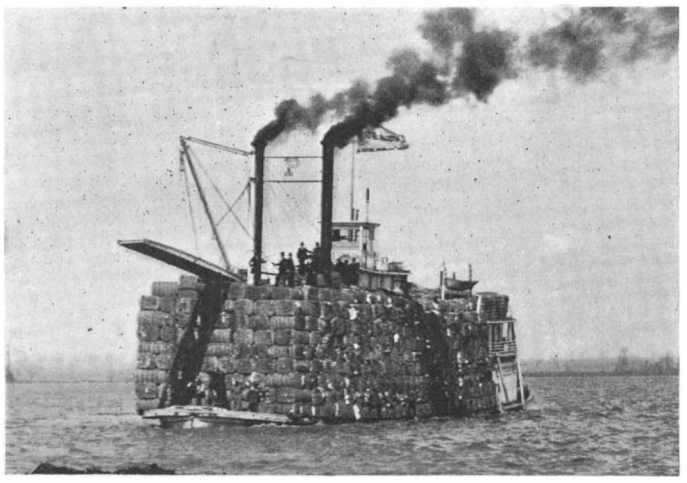
It has been found that arsenic occurs in easily detectable quantity in the hair of persons who have been taking the drug either medicinally or accidentally, as in the case of beer. The observation is of the utmost importance in affording a decided aid to the diagnosis of arsenical poisoning. A method of examining the hair by means of an ammonia copper solution containing an excess of the precipitated copper oxide has been recommended.

In patients taking small doses, the medulla of the hair will remain unchanged, as far as a half-inch objective is concerned; but when viewed by a sixth-inch objective, the small green particles of arsenite of copper are seen appearing as green granules without definite shape or formation. Dr. Reid was led to think that this simple test might prove useful forensically, says the Lancet. In some patients the quantity of arsenic found is too minute to be estimated, but in a patient who is taking the drug medicinally, the hair was found to contain arsenic in the proportion of 0.3 in 10,000. One of the patients who had been drinking arsenical beer had present in his hair the same proportion of arsenic, while another showed as much as 1 part of arsenic in 10,000. The method employed for the estimation of arsenic consisted in first destroying the hair by means of fuming nitric acid, then dissipating the excess of nitric acid, after which the product is transferred to the Marsh apparatus. There is abundant evidence now to show that the fate of arsenic in the body is partly in the hair, and this cannot but be of the utmost importance in medicine, especially in toxicology.

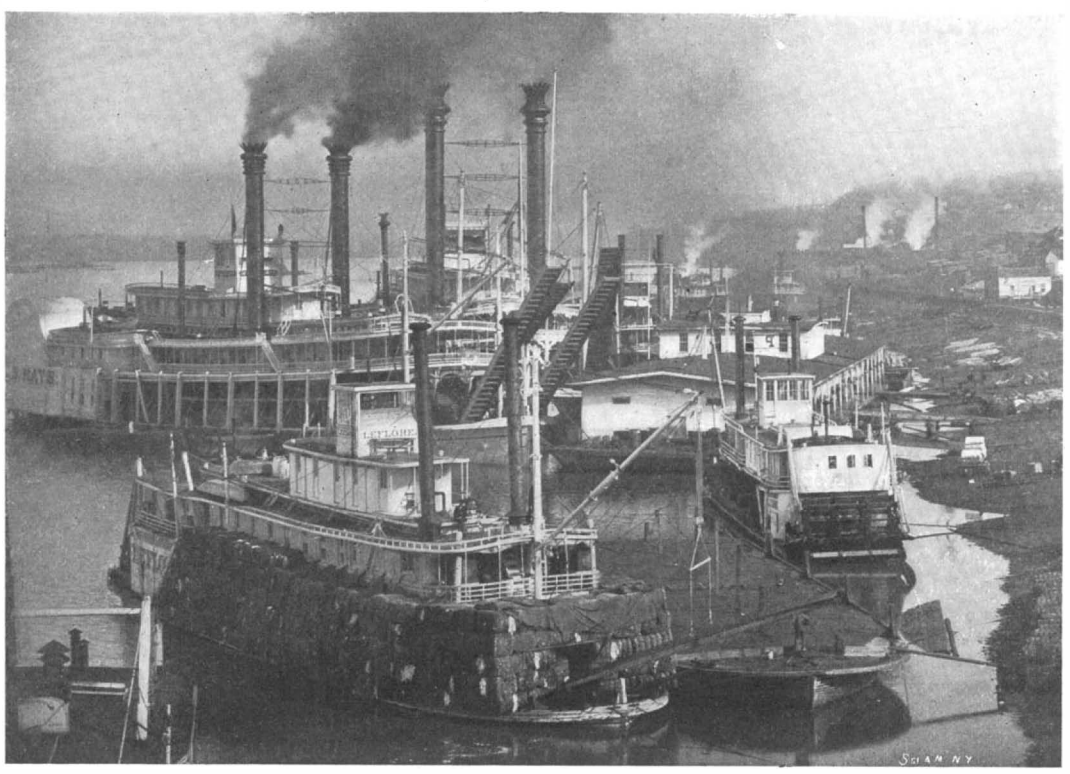
STERN-WHEEL STEAMERS ON THE MISSISSIPPI RIVER.

Although the development of the railroad system of this country, paralleling as it did the main arteries of water transportation, was a severe blow to the river steamship lines, the latter were by no means forced entirely out of the field of competition. There are certain classes of freight and passengers which still seek the river routes, and in spite of the vast reduction that has been made in railroad rates during the past two decades, transportation by water is still cheaper than by land. Naturally the inroads made by railroads upon river traffic were chiefly in the direction of passenger travel and of those classes of freight in which rapidity of transit and delivery was a leading consideration. The truly magnificent river steamers of the Mississippi—floating palaces, as they were not unjustly called—have had to give way as a means of passenger travel to the swifter, if less spacious and comfortable, railroad car; and while a few of the old passenger boats are still running, they are rarely crowded after the fashion of early days. In the transportation of freight in bulk, however, the river steamer still handles an enormous tonnage, not merely on the Mississippi proper, but on its tributary streams. The coal fields of Pennsylvania keep busy a vast fleet of peculiar, two-funneled, stern-wheeled steamers on the Ohio and Allegheny; while the products of the cotton fields of the South maintain an equally busy fleet on the great river itself.

These river steamers are purely an American product. Their peculiar form and the method of placing the motive power have been called forth by the nature of the rivers and the peculiar difficulties encountered in passing over shallow waters and through the swiftly-eddying currents of tortuous channels. The hull of the typical river steamer will have a draught which will vary from 5 to 6 feet to not more than 18 inches. The cargo is carried almost entirely on the main deck. On account of the shallow depth of the hull, care has to be taken to distribute the weights so as to prevent distortion of the hull, which is stiffened, either by means of a pair of timber trusses extending from bow to stern, or by a system of hog chains which are attached to the hull in the wake of the boilers and engines and so placed as to prevent the "hogging" effect of these loads upon the hull. In the type of river steamer shown in our illustration, the boiler is placed a third of the distance from the bow, while instead of the side wheels to which we are accustomed in Northern waters, a single stern wheel is used, which is carried across the square stern of the steamer, and is driven by a pair of high-pressure engines of abnormally long stroke, the engines being bolted to the main deck, one on each side. The connecting rod is of great length, and consists of a single stick of timber heavily strapped with iron. These steamers make landings, not merely at the regular stages, but at all manner of out-of-the-way places on the river banks. To facilitate the landings, forward in the bows they carry one or more gang-planks, which are handled by means of a derrick operated by a steam winch. In making a landing, the boat pushes her nose into the bank, swings the gang-plank ashore, and after discharging or taking on freight or passengers, raises it and backs off again to deep water, the whole landing being made with remarkable speed. The picture presented by some of the cotton steamers when they are loaded to their utmost capacity is decidedly striking, and to eyes accustomed to deep-sea navigation it certainly looks extremely perilous. In the accompanying illustration, the cotton is not only loaded on the main deck, but it is carried up above the upper deck, and even over the boat deck. The cotton is light for its bulk, and therefore the center of gravity of the enormous pile of cotton bales is not so high as might at first sight appear. The wide beam of these vessels, moreover, gives them great stability, and, except in the event of their being struck by a side wind of hurricane force, there is no special risk of capsize



A Full Cargo.



The Water Front at Vicksburg.

STERN-WHEEL STEAMERS ON THE MISSISSIPPI.

Sumatra Eclipse Expedition.

A message just received by President Pritchett from the Boston Institute of Technology eclipse expedition, on its way to Sumatra, gives good news of the progress of the party and of the good health of its members. Prof. Burton writes that all the instruments have been safely landed and placed on board the steamer, and as this steamer goes directly to Padang there ought to be no doubt of the safe arrival of the men and instruments in Sumatra.

© 1901 SCIENTIFIC AMERICAN, INC.

THE PRESENT STATE OF X-RAY WORK.

BY PROF. WILLIAM C. PECKHAM.

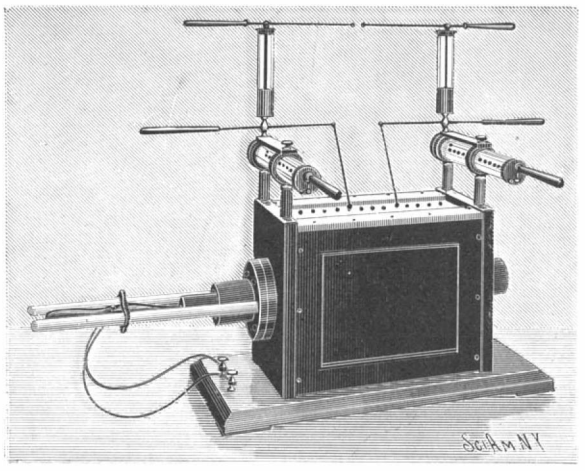
Five years have elapsed since Prof. Roentgen startled the world by the announcement of his discovery of the rays which are now quite commonly called by his name. We can now judge whether it is to be of permanent value to man.

We must admit that no more is known to-day as to the essence of the rays than was contained in Prof. Roentgen's original paper. Thus their identity in character with light rays has not been established by the usual tests. They do not behave like any other radiation known to science; yet scientific men are generally of the opinion that they belong in the ultra-violet region of the spectrum, perhaps having the shortest wave length of any known radiation—so short that it is not possible to deviate them from their course by any known form of reflecting or refracting substance. It is not settled whether the rays originate within or on the outside of the tube. Some hold that they proceed from the anode within the tube, pass through the glass and on in straight lines. This seems a most reasonable view, since the platinum of the anode is the seat of the highest activity while the tube is producing rays, becoming white hot under its terrific bombardment from the cathodic streams. But others hold that these streams, upon striking the glass of the tube, set up the X-rays, which therefore proceed only from the outside of the glass.

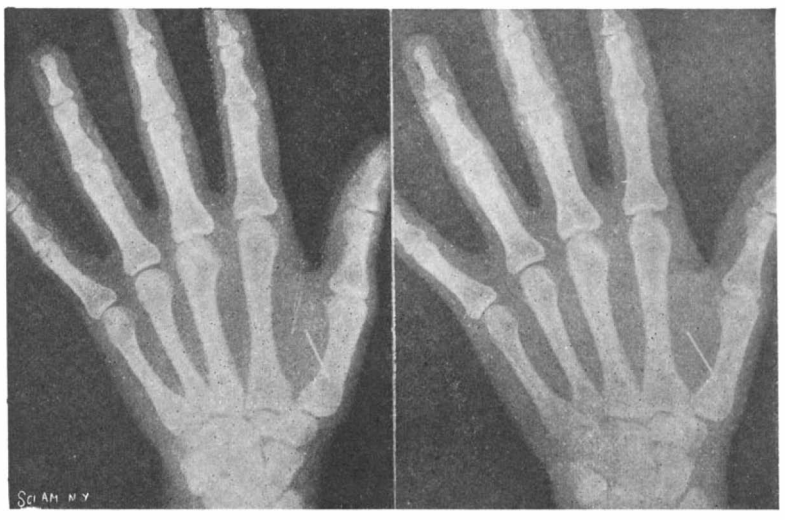
In disclosing and locating foreign bodies buried in the tissues, great progress has been made. There are now several apparatus by means of which the combination of two radiographs will show the location of the article sought at the intersection of two lines drawn through the body of the patient. A simpler method for reaching the same result has been devised by Dr. G. P. Girdwood, of McGill University, Montreal. He has succeeded in making stereoscopic radiographs. This is done by making two exposures, one after the other, from points two and a half inches apart. These points are accurately located, and the tube is placed with exactness in the positions determined for it. The two exposures are made exactly alike, and the plates are developed as nearly alike as possible. We reproduce herewith a hand in which is a needle. Before the stereoscope the appearance of solidity in these pictures is remarkable. The reader may verify this with a stereoscope. The exact location of the needle is easily seen. It is upon the palmar side of the hand, inclined from the thumb bone toward the center of the hand. The cut can be made with all the certainty of vision, down across the needle. In the case of fractures and dislocations, the stereoscopic view shows the exact location of the disturbing fragment of bone, and the setting can be made with certainty. A curious feature of these views is that they are reversible. If you look at the picture from one side, the view is as a front view; if from the other side, the view is a rear view.

Five years ago it was thought impossible to make a picture which would show the condition of the soft tissues of the body. This is now easily done. Almost every organ of the body can be depicted upon the sensitive plate. Enthusiastic practitioners with the rays claim to be able to detect the existence of certain diseases before the ordinary symptoms can be heard or seen, and while, in many cases, they are still curable. The various calculi of the bladder, gall sac, and the kidneys may be located. The surgeon may know when to operate upon a kidney with certainty. Consumption, even in its incipient stages, may be demonstrated, and the condition of the lungs may at any time be portrayed. An X-ray photograph will show a cavity of the lung, or a space filled with liquid, or an adhesion. Some claim that consumption in its early stages has been cured, and the dread lupus has been destroyed by direct application of the rays.

The later forms of tubes leave little to be desired. The penetration has increased with the development of the tube, until to-day a good picture of the thickest parts of the body can be had in a few minutes' exposure. In recent forms of tubes the vacuum is adjusted automatically by inclosing a substance which may be vaporized by heat.



THE A. W. L. UNIVERSAL COIL.



A STEREOPTICON RADIOGRAPH FOR LOCATING FOREIGN OBJECTS.

In the static machine many changes have been made since they have been employed for X-ray work. They are now built with sixteen plates, eight revolving plates, of 72 inches in diameter. Even greater advances have been made in the construction and design of the induction coil, and now few large coils are made with a cylindrical secondary. A spark length of one inch per pound of secondary was considered large not long ago; but coils are now built giving much more than this.

A coil recently designed by Dr. Rollins presents features of interest. It is a universal coil, giving sparks of all lengths up to its maximum length of 13 inches. There are thirteen sections in the secondary. These are joined to each other, and the junctions of the sections are brought out to balls upon the top of the box, as is shown in our cut of this coil. The sliding rods, bent at right angles, control the number of sections which are in action at once. When the rods rest upon adjacent balls, a spark of a quarter-inch is given. The rest of the secondary is idle. Above these discharging rods are seen two Leyden jars, to the inner coatings of which are connected two rods which may be brought together or separated, varying the character of the discharge accordingly. The horizontal glass tubes contain a multiple spark gap. By adjusting these the proper spark gap for the tube may be quickly obtained. The primary coil is also movable, and may be slid in and out by the handle on the left, so that the inductive action may be made weaker or stronger, as desired. With all these adjustments at one's disposal, a tube can be taken, which shows only a reddish Geissler discharge, and brought up to full power in a few seconds. Most of the separate features of this coil are not new, but their combination gives the operator a range of power and resources which he has not had in one apparatus.

ELECTRICAL GYROSCOPES.

BY HOWARD B. DAILEY.

The advantages of a gyroscope whose action can be maintained for any desired length of time are obvious. Mr. George M. Hopkins in "Experimental Science" has described several forms of this curious instrument in which the various agencies of steam, compressed air, and electro-magnetism are ingeniously employed to render the rotation of the disks continuous. The apparatus represented in the accompanying engravings are unique, as they are possibly the first examples of continuously-acting gyroscopes using static electricity as a motive agent. Fig. 1 is a modification of that familiar type known as the "gyroscopic top," or unbalanced gyroscope, whose singular gravity-resisting powers seem to defy all attempts at satisfactory explanation in any simple, popular way. In this experiment a 6-inch disk of sheet vulcanite 3-16 of an inch thick is mounted on a short pivot-pointed steel axle, in a frame formed of two parallel pieces of light vulcanite tubing. The upper ends of these tubes, which are of unequal lengths, are fitted into parallel grooves in the opposite sides of a 2-inch hollow wooden ball; and are secured in place by a slender binding rod of straight brass wire, whose threaded projecting ends are provided with polished aluminium screw knobs. The hollow ball is obtained by splitting a solid ball in halves, which are hollowed out as thin as possible and glued together again, after which it is given a conducting coating of tin-foil cemented on in small pieces with shellac varnish. The surface is then carefully rubbed down with some smooth instrument. Hollow balls and tubing are used for the reason that the less weight the gyroscope has to sustain, the slower and more stately will be its movement about its point of support. The shorter of the vulcanite tubes has passing through its lower end a cup-pointed brass screw, which serves as the outer bearing of the axle; the inner bearing being an indentation in a light brass sleeve embracing the longer tube at about its middle, and forming the anchorage for the 3-16-inch steel arm upon which the gyroscope proper is suspended. The lower end of the longer tube bears a small dumb-bell shaped aluminium receiver, presented endwise toward the disk, and adjusted, like the wooden ball, very close to its edge. The two insulated receivers gain opposite electrification from stationary points of supply through flexible rubber-covered conducting cords in a manner presently explained.

The vertical support for the gyroscope is a rod of vulcanite, eleven inches high. In its upper end is drilled a 5-16 inch hole 3 inches deep. A pointed steel pivot upon which the system revolves passes loosely through a brass bushing in the upper end of the hole and rests in a cone-shaped depression in a

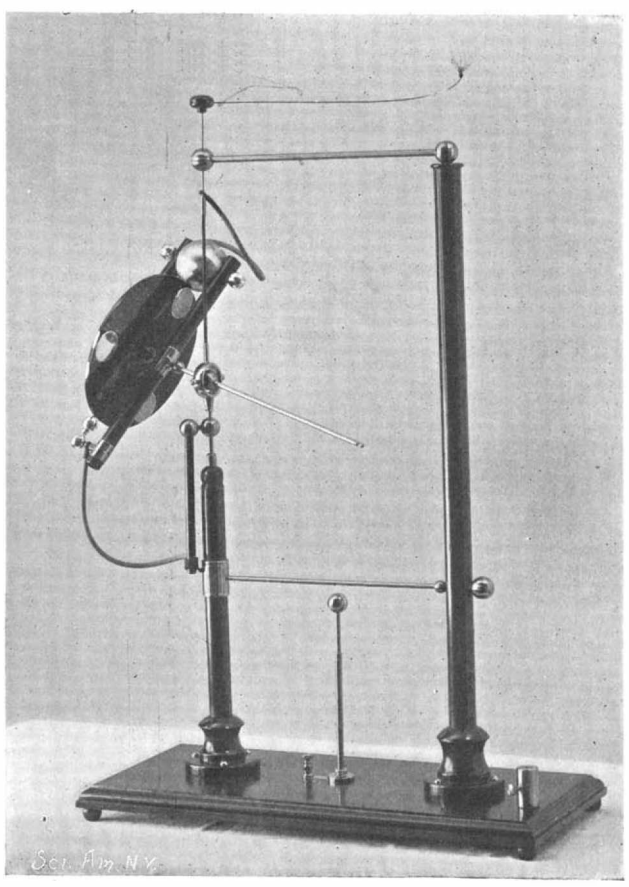


Fig. 1.—ELECTRICAL GYROSCOPE.

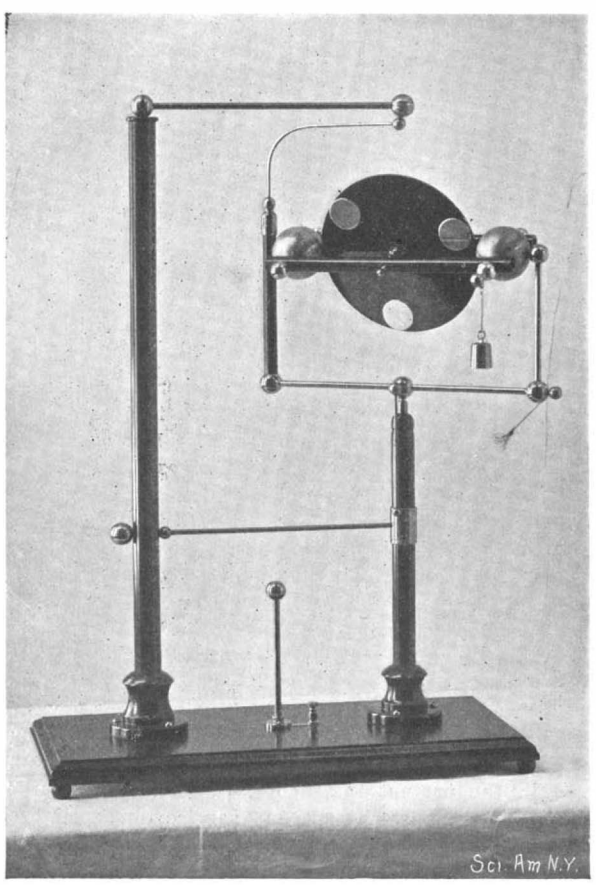


Fig. 2.—BOHNENBERGER APPARATUS DRIVEN BY STATIC ELECTRICITY.

© 1901 SCIENTIFIC AMERICAN, INC.

piece of hardened steel at its bottom. The pivot carries at its upper extremity a brass ring in whose center is hung on two horizontal pivot points a brass ball through which the supporting arm of the gyroscope passes. This arm may be fastened in any desired position by a blind setscrew. The best adjustment for the frame is that which gives it an angle of about 45° with the vertical, when the axis of the disk is horizontal. The arm is prolonged several inches to the rear of the central mounting, to serve in the usual experiments requiring the use of the counter-balance, which is seen standing upon the base of the apparatus.

A tall vulcanite column at the right of the instrument carries at its top a horizontal brass arm terminating in a knob exactly over the center of the gyroscope vertical support. In electrical communication with this knob is one end of the flexible cord attached to the large receiver. The lower end of a similar cord depending from the smaller receiver is held nearly in contact with a stationary electrified brass sleeve on the rubber standard of the gyroscope; the cord being fastened to the lower end of a slender vulcanite rod carried by the revolving pivot stem of the instrument. A metal bar extending horizontally from the sleeve through the column at the right ends in a brass ball, which, with a similar one at the top of the pillar, are the points of connection with the opposite poles of the static machine; the upper one being made *positive*.

The wheel of the gyroscope has cemented upon each face, close to the edge, three round pieces of sheet aluminium 1¼ inches in diameter; the two sets of pieces being arranged in such relation to each other that the disks of one set come between those on the opposite face of the wheel. These pieces act as carriers for the electricity.

Experimenters with the gyroscopic top have observed that if the instrument's circular movement about its point of support be retarded, the gravity-resisting power is impaired, and the device falls rapidly. Conversely, if this orbital motion be accelerated slightly by the application of some gentle outside force, increased lifting power is at once apparent, and the horizontal plane of rotation of the system can be made to remain at a given level or even to rise, instead of gradually falling, as is the natural action of all overhanging gyroscopes not subject to the aforesaid outside influences, even when provided with power-driven disks; unless the axis of the disk be given a *very pronounced* upward inclination at the beginning. In the present case such an extra force as is mentioned above is conveniently supplied by the mechanical reaction produced by a current of electrified air—"electric wind"—emanating from a number of electrified metallic points at the end of a laterally curved horizontal wire sweep, carried by a vertical shaft passing loosely through the charged brass knob above the apparatus. The very mild torsional force thus secured is communicated to the vertical spindle of the gyroscope by a slender vulcanite rod, extending downward, and entering the top of the brass pivot ring. There is a position of maximum efficiency for the sweep to occupy in relation to the body of the gyroscope; this position being fairly indicated in the engraving. The points, which are of tinsel wire, are turned in a direction contrary to that of the natural motion of the system about its vertical axis.

A regulator for controlling the strength of this force is placed upon the base of the instrument between the two standards. Its operation depends upon the circumstance that the grounding of one pole of an influence machine greatly increases the electrical activity at the other; consequently, air currents from points attached to one pole of a generator will be made stronger or weaker, according as the opposite pole is more or less completely grounded. The regulator is a vertical sliding earth-connected brass rod with a ball at its top, which by being lowered or raised forms a longer or shorter spark-gap between itself and the horizontal supply-rod above it; thus grounding more or less perfectly, as desired, the negative side of the generator, and causing increased or diminished potential at the other pole. Like the pneumatic gyroscope of Mr. Hopkins, this machine raises itself automatically from its lowest position, by a spiral movement, into a horizontal plane of rotation, whose altitude above the base becomes constant at a point determined in the present instance by the adjustment of the regulator and by the speed of the generator.

A continuously acting Bohnenberger apparatus is shown in the second illustration. This arrangement utilizes the same base and supporting standards as are used in the preceding experiment; but instead of the overhanging gyroscope we have the disk revolving in a horizontal vulcanite frame at whose ends are located large balls of foil-covered wood. The frame is pivoted at its extremities so as to balance accurately in any position. The two vertical supports for the frame, which are of brass and vulcanite, respectively, rise from the ends of a horizontal metallic bar mounted at the top of the vertical pivot on which the apparatus turns. The ball at the left of the disk receives positive electrification through a stiff curved wire, rising from the top of the vulcanite support; the upper end of the wire terminating in a knob just below the charged conductor above the instrument. The other ball obtains negative electricity from its metal supporting connections, which are charged through a traveling conducting rod attached to the vertical pivot and reaching down very near to the excited brass sleeve below the gyroscope. Owing to the accelerative effect of a reactionary air current upon the azimuthal rotation of the apparatus, as in the preceding experiment, the small weights usually hung upon the side of the frame for throwing it out of balance in exhibiting the composition of rotations are continuously sustained. However, as these weights may be made as light as desired, the use of the regulator for intensifying the air jet is unnecessary; and the tinsel brush is fastened by a short piece of wire directly to the lower right-hand corner of the supporting frame of the instrument in such a manner as to admit of being turned in either direction.

INSHORE END OF THE STIFFENING TRUSSES OF THE NEW EAST RIVER BRIDGE.

The means by which the rotation of the disks is effected is in itself interesting, and affords a pleasing illustration of the law of electrical attraction and repulsion. The wheel is first given a slight impulse with the hand. As the aluminium carriers pass the oppositely charged receivers they gain from each one its own particular sign of electrification, and repulsion between carriers and receivers ensues. Rotation proceeds, and as each carrier approaches an oppositely excited receiver attraction between them results until, coming near enough, their electrification is reversed; repulsion replacing attraction as they pass by. Each receiver attracts the carriers on that half of the disk which is approaching it; repelling those on the half which has passed—a swift continuous motion being soon established. It is found that the direction in which the disks revolve most rapidly in both instruments is that in which their top edges approach the positively excited receivers. In dry weather, when other experiments in static electricity succeed, the action of these curious machines is very gratifying and instructive; and much might be said of the beautiful and intricate system of delicately correlated forces—electrical and gravitational—which their operation illustrates. They may be used with any static machine having four or more 22-inch revolving plates.

Several towns in West Virginia have free telephone service on account of competition between local and Bell companies. At Huntington, W. Va., the Bell company gives its service to all subscribers free until further notice. The home company has not cut its rates, and the number of telephones has increased.

CONSTRUCTION OF THE NEW EAST RIVER BRIDGE.

Now that the actual work of constructing the cables of the new East River Bridge is under way, it is opportune to consider both the cables and the broad and massive suspended roadway, the completion of which will mark the completion of the whole structure. The cables will be four in number, and each will consist of thirty-seven strands of wire, with 281 wires in each strand. There will, therefore, be in each cable 10,397 wires, or 41,588 in the four cables. The wire will be 0.165 inch in diameter, and it will have a breaking strength of 100 tons to the square inch. Before its acceptance from the manufacturers it must stand the test of being coiled cold around a wire of its own diameter without cracking.

In designing the cables and in the specification for the manufacture of the wire, particular care has been taken to protect the wire from rusting. At the mill the wires are passed through hot linseed oil. When the 281 wires of each strand have been laid parallel with each other and banded at intervals of every 5 feet to hold them temporarily in place, the interstices will be filled with a special, anti-oxidation filling. Then again when the 37 strands are assembled in the complete cable, the wire wrappings will be removed, and the interstices between the strands will be similarly filled with a non-corrosive preparation. As the strands are assembled in the cable the whole of the 10,397 wires will be drawn snugly into cylindrical form, the main cable bands being put on at intervals of 20 feet, and screwed up so as to take a firm grip upon the cable. In addition to the protective preparation, which thoroughly fills up the interstices between the wires, the whole cable will be protected by 1-16-inch steel cover-plates, which will extend from main band to main band, with ends overlapping, so as to shed the water.

The floor system of the new bridge is by far the widest and stiffest ever carried by a suspension bridge. Its extreme width is 118 feet, and its depth measured at the stiffening trusses is 40 feet. These dimensions may be compared with those of the Brooklyn Bridge, whose total width is only 80 feet and the depth of the trusses 17 feet. Moreover, the carrying capacity of the floor system is much greater, provision being made for six railroad tracks, two roadways for vehicle traffic, two 11-foot footways for pedestrians and two 10-foot bicycle tracks. The framework or skeleton of the floor system, or what we might call its backbone, are two massive latticed trusses, 40 feet in depth, which extend from end to end of the bridge. These trusses possess great vertical stiffness, and should there be any uneven loading, such as would be caused by a bunching of the elevated trains and trolley cars, and a crowding of people and vehicles at one particular spot, the trusses will take care of this load and distribute it indefinitely throughout the full length of the span and prevent any sagging of the cables at that particular point. Intersecting the bottom chord of the two trusses at right angles, at every 20 feet of their length, is a series of deep, plate-girder, floorbeams, which extend entirely across the bridge for its full width of 118 feet. Each floorbeam is suspended from the four cables overhead by 1¾-inch steel wire cables, which pass up and over curved saddles, formed in the main cable bands. These cables at their lower ends pass under a cast-steel saddle, from which four heavy bolts pass down and are bolted beneath the covering plate of the bottom chords of the trusses. At every 20 feet of the length of the trusses, and in the same plane as the suspenders, the top chords are connected by transverse steel trusses, from which two plate-steel suspenders are carried down and riveted to the floorbeam at two points intermediate between the trusses. These overhead trusses relieve the girders of the great concentration of the load due to the six railroad and car tracks, thereby permitting the floor beams to be much shallower than would otherwise be necessary, and gaining several feet of valuable headroom between the under side of the bridge and the water level of the river. The 20-foot gaps between the floorbeams are bridged over by plate-steel stringers which are so distributed that they will come approximately beneath the lines of the rails of the street car and elevated railroad tracks. The two roadways for vehicles will be carried on the cantilever extensions of the floorbeams outside the trusses. Immediately inside of each truss will be two tracks for street railway cars, while between these will be two tracks for the elevated railway lines. Immediately above the street car tracks, and carried by the trusses and the intermediate suspenders of the floorbeams, will be

© 1901 SCIENTIFIC AMERICAN, INC.

the platforms for pedestrians and bicycle traffic, an iron hand-rail serving to separate the two. As compared with the Brooklyn Bridge, it will be seen that the convenience of the public, as regards the latter form of travel, has been consulted by providing separate roadways for east and west bound traffic.

The stringing of the main cables will be carried on from two temporary footbridges. These footbridges will each be carried upon two cables, each cable consisting of three 2¼-inch cables. On April 9 the first of these cables was carried across the river, the method adopted being different from that followed in the case of the Brooklyn Bridge. The ends of the cables were first carried up over temporary saddles on the top of the New York tower and drawn down to the New York anchorage, where they were made fast. The drums containing the rest of the cable, say about 1,900 feet, were placed abreast upon a large scow which was towed sideways across the East River to the base of the Brooklyn tower. During the passage all river traffic was stopped, and the cables were allowed to sink until they rested upon the bottom of the river. The next step was to hoist the Brooklyn ends of the cables over the tower, carry them down to the anchorage and draw them taut until the desired curve had been obtained.

In conclusion, it may be well to recapitulate some of the leading dimensions of the bridge. Its entire length between terminals is 7,200 feet; length of main span, center to center of the towers, will be 1,600 feet; the foundations of the towers are timber and concrete caissons sunk to bed-rock. On these are masonry piers which are carried up to 23 feet above high water. The steel towers extend 335 feet above the river and 442 feet above the lowest foundation. The anchorages for resisting the pull of the cables measure 182 feet in width, 158 feet in depth and 120 feet from the foundations to the coping. Forty feet of the mass will be below the street level, above which it will extend some 80 feet. Each anchorage contains 44,597 cubic yards of masonry, and its total weight is 125,000 tons. The total pull of the four cables upon each anchorage is 20,250 tons.

Automobile News.

A very handsome automobile has been made for King Leopold II., of Belgium, by Panhard & Levassor, of Paris. The carriage-work of this machine is of the most elegant design and construction. The body, of aluminium, is finished in red, with the truck in blue. The wheels are of blue, relieved with red. All the wood parts which are visible are of polished mahogany. The seats are of a new design and very comfortable; they are covered with red morocco. The motor, of the petroleum type, is rated normally at 20 horse power, but will give as high as 30 at full capacity. It has four speeds, 12, 24, 36 and 48 miles an hour and a back movement, all controlled by a lever. The ignition is by spark, with Basée & Michel induction coils. The machine has been lately delivered to King Leopold at Nice.

An interesting experiment with an automobile upon a snow-covered route has been lately made in France. The Baron Xavier Reille, Deputy of Tarn and the Mayor of Lacanne-les-Bains, in an 11-horse power machine, made a trip of 32 miles in 2 hours and 35 minutes over a hilly road covered with 10 inches of snow, which proved impracticable for ordinary vehicles. This road leaves from Castres, at 600 feet altitude, and then mounts to 1,200 feet, ending at Lacanne-les-Bains at 2,700 feet altitude. As the old system of diligences had considerable difficulty over this road, especially in winter, it was desired to replace these by automobiles, and the present trip was made with this end in view. The experiment has proved conclusive, and this spring a line of automobile vehicles will travel over the route.

M. Serpollet, the constructor of steam automobiles, had a rather amusing experience not long ago. He had just finished a new disposition of one of his machines, and as it was a fine moonlight night, decided to try it at once, without waiting for the next day. So he started, with a mechanic, to make a tour in Vincennes Park, but as the machine went at a great speed they found themselves at the end of half an hour at Pont-Carré, a considerable distance from Paris and much farther than they had thought of going. As they had only a small supply of petroleum this soon gave out, and the question of the return trip was somewhat of a problem. They succeeded, however, in overcoming the difficulty. Stopping at the edge of the forest of L'Echelle, they modified as well as possible the receptacle of the petroleum burner and placed in it small pieces of wood to heat the water; this lasted for about a mile and a half, when they were obliged to stop and collect a new supply of wood. This operation was repeated over a distance of 12 miles, which they covered with great difficulty in three hours. Finally arrriving at a farmhouse they obtained a supply of petroleum, and the remainder of the trip was quickly made.

Electrical Notes.

More than ten thousand telephones in Detroit, Mich., were rendered useless on March 10 by the rain, which fell and froze during the entire morning. The thirty miles an hour wind which accompanied the rain raised havoc with the wires, weighed down as they were by ice. Officials of the Michigan Telephone Company estimated their total loss in the State at $20,000. Street-car service was greatly impaired during the morning by the ice. The storm was general throughout the southern part of the State, wires suffering everywhere.

Important experiments in electric traction are being carried out by the German government with a view to the possible introduction of electricity on some of the state lines. On an experimental line at Lichterfelde it has been found possible to convey directly to the locomotive currents of high tension which are transformed to the required working pressure on board the locomotive itself. Experiments on a considerable scale will be made on the Mariendorff-Zehlendorff line, which is about 14 miles long. The cars will be 87 feet long, will have 60 seats, and will be heavy. It is expected that a very high speed will be developed.

Mr. T. O. Moloney, in The Electrical Review, says that a piece of the best India mica was placed between two planed surfaces, and withstood an insulation test of 16,000 volts alternating current without fracture. The current was then removed, and the surface of the mica lightly coated with paraffine oil, and it was again placed between two planed surfaces. Under this condition it was found that it would break down at 9,000 volts alternating current. Another piece of India mica tested at lower voltages and under the same conditions as above was found to withstand 8,000 volts alternating, dry, and when oil was applied to break down at 4,000 volts alternating current. Tests were made, using three different grades of oil, paraffine, linseed, and lubricating, and all gave approximately the same results. The surface of the mica can be coated with water, and the insulation of the mica will not be lessened. A series of tests on mica immersed in oil showed the effects to be same as when coated.

Marconi is experiencing some trouble with the British Post Office department regarding the introduction of his system into the United Kingdom. By means of an Act of Parliament, passed in 1863, the government has a monopoly over any telegraph systems used in the country, since in this Telegraph Act it is stated that "the term 'telegraph' means a wire or wires used for the purpose of telegraphic communication, and any apparatus connected therewith." In view of the fact, however, that Marconi dispenses with wires, this act is quite inapplicable in his case, but as if anticipating the possibility of ethereal communication, the act was amended in 1869. It now reads: "The term 'telegraph' shall in addition to the meaning assigned to it in the Telegraphs Act of 1863, mean and include any apparatus for transmitting messages or other communication by means of electric signals." As an additional precaution against private enterprise, the Postmaster-General is accorded the sole privilege of transmitting telegrams within the United Kingdom.

Several attempts have been made from time to time to test the fairness and validity of the government's monopoly, but in every instance the latter has triumphed. Therefore it will be realized that Marconi is placed at an unfair disadvantage, and the scope of his experiments is exceedingly limited. If the postal authorities feel so disposed, they could compel the inventor to close all his experimental stations, since Marconi has never received the official permission for their erection. Two years ago the company which has the control of the patents applied to the Postmaster-General for the necessary license to use the system on land in England. The government has not yet replied to the application, probably under the impression that the granting of such a license would have been tantamount to submission on the part of the Post Office. Yet, although the government possess such a monopoly, they are unable to adopt Marconi's invention without awarding him compensation, either by purchasing the system outright, or by the payment of a royalty. Marconi is amply protected by the Patents Act. By this means the government is placed in the same position as a private individual. Marconi has patented all his inventions, and should the government utilize any of them, an infringement is committed, and the inventor can obtain redress in the usual manner. The result of this controversy is that at present a deadlock exists between the government and Marconi, the solution of which can only be obtained by the former awarding the inventor satisfactory financial compensation for the use of his system. This arrangement has been adopted by the Admiralty department, regarding the installation of the instruments in the navy. Doubtless some such arrangement will shortly be concluded between the government and the inventor, the effect of which will facilitate the introduction of wireless telegraphy into the postal system of the country within the near future.

Correspondence.

American Naval Construction.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of February 9 you were kind enough to discuss editorially my method of determining the military value of warships.

I thank you for your considerate article; since an international discussion of the question would do much to clear away present difficulties, and would lead to results which would be of value, not only to the constructor and naval officer, but also to the financial department of every government.

I have concluded my work in the March number of the Marine Rundschau, so that anyone can now carry out the mathematical calculations necessary to determine a vessel's fighting efficiency. In the periodical in question, I have also ranked American ships very high in the list of war vessels, and given the "Alabama" the value:

$$13.05\ PA \text{ or } 1.1\ PA_D.$$

I consider these values correct. Perhaps they would be still higher if I had better data at my disposal. So far as the comparative constructional fighting values are concerned, or, in other words, the values per ton of displacement, the "Alabama" must stand high in the list. For the naval constructor these comparative values are of the utmost importance.

I cannot too highly compliment your worthy and famous Chief Constructor, Rear Admiral Hichborn, on his skill in giving to a vessel of the small displacement of 11,525 tons so large a fighting value as 1.1, especially when it is considered that the "Mikasa," a vessel of 15,200 tons displacement, has but a fighting value of 1.0.

With the last sentence in your editorial I cannot agree. I hope that my last published essay may do much to clear this very important question of many obscurities, and that the possibility has been shown of constructing a fighting ship on mathematical and scientific principles.

OTTO KRETSCHMER,
Chief Naval Constructor, German Imperial Navy.
Berlin, March 19, 1901.

Armored Cruiser Discussion.

[We have received a lengthy communication from Mr. Paul D. Emmons replying to criticisms which appear in our issue of April 6 of his proposal to substitute 7-inch guns for the 6-inch guns in the batteries of our new armored cruisers. The letter which is too long for insertion in the SCIENTIFIC AMERICAN will be found in the current issue of the SUPPLEMENT. —Ed.]

Explosive Effects of Bullets.

The question investigated by C. Cranz and K. R. Koch in Ann. d. Physik, was whether the "explosion" of tissues produced by a high-velocity infantry bullet takes place while the bullet is still within the body, or after it has already left it. To imitate the action of blood-vessels while having recourse to a clearly defined physical structure, the authors employed tin cylinders filled with water, and closed at one end with parchment, and at the other with an indiarubber membrane. The rifle experimented with was a new 6 millimeter model made by Mauser at Oberndorf, and having a muzzle velocity of 100 meters in excess of any hitherto used. The method of taking the photographic records was a modification of that devised by Mach. The circuit of a battery of Leyden jars was interrupted by two spark-gaps. One of them lies within the liquid, or in its immediate neighborhood. Its knobs are covered with glass tubes, so that the spark can only pass when they are shot through. The other spark-gap lies in front of a concave mirror in such a position that its image falls on the shutter of the recording camera. This gives a silhouette of the water-vessel on the sensitive plate. In some of the experiments, the bending aside of the bullet by the water made it necessary to have another method of making the circuit. This was then done by the mechanical action of the issuing water-jet in bringing one electrode into contact with the other. The general result of the experiments is that the "explosion" takes place some time after the bullet has left the body. The authors discuss the various theories framed to account for the phenomenon. It is not due to evaporation, as the temperature of the bullet in no case exceeds 150 degrees. The introduction of large masses of gas into the body has no evidence to support it. The rotation of the bullet is too slight to produce the effect, and the deformation of the bullet cannot be the main cause, as explosive effects are produced when there is no deformation. The only remaining theories are those based on sound waves and on the acquired velocity of translation. The authors favor the latter. Part of the kinetic energy of the bullet is transferred to parts of the body in the vicinity of the path of the bullet, and takes some time to produce its effect. But when this takes place a considerable portion of the body is torn away from the anterior portion.

© 1901 SCIENTIFIC AMERICAN, INC.

MODERN BRITISH ORDNANCE.

BY WALDON FAWCETT.

It is generally admitted that of the convictions which have been brought home to the British military authorities by the conflict in South Africa, none has been impressed more forcefully than the necessity

12-POUNDER ARMY FIELD GUN.

for the infusion of a more liberal and more progressive policy in the ordnance department. The artillery branch of the army service has had to bear perhaps more than its share of the brunt of the Boer-Briton struggle, and the forces of the United Kingdom, if not actually outclassed by the equipment of heavy weapons in the possession of the Boers, have at least been brought to a realization that their sinews of war of this class are scarcely in keeping with the prestige of the military establishment with which they are connected.

If the British guns have ever been at fault in efficiency, however, certainly the artillery complement has not been lacking in variety of weapons. It is doubtful if any other force which engaged in operations of warfare during the century which has just closed brought into the field so many different classes of ordnance. An enumeration of other than the principal designs would prove burdensome. The Royal Field Artillery placed its chief reliance on the 15-pounder breech-loading gun of three inches caliber and a range of 4,000 yards with shrapnel. These guns are a trifle over seven feet in length and are rifled with eighteen grooves. Six guns make up a battery, and each with ammunition carriage and ammunition weighs in the neighborhood of two tons. The breech mechanism includes the De Bange pad for preventing the escape through the breech of a portion of the gases generated by the explosion. Shrapnel was used almost exclusively in the 15-pounders in service in South Africa, but case-shot was also used to some extent. Capable military critics have declared that the failure to furnish common shell to the 15 pounders was one of the serious mistakes of the South African campaign, inasmuch as the common shell not being restricted in usefulness by the burning time of a fuse would have increased the range of the guns to fully 6,500 yards.

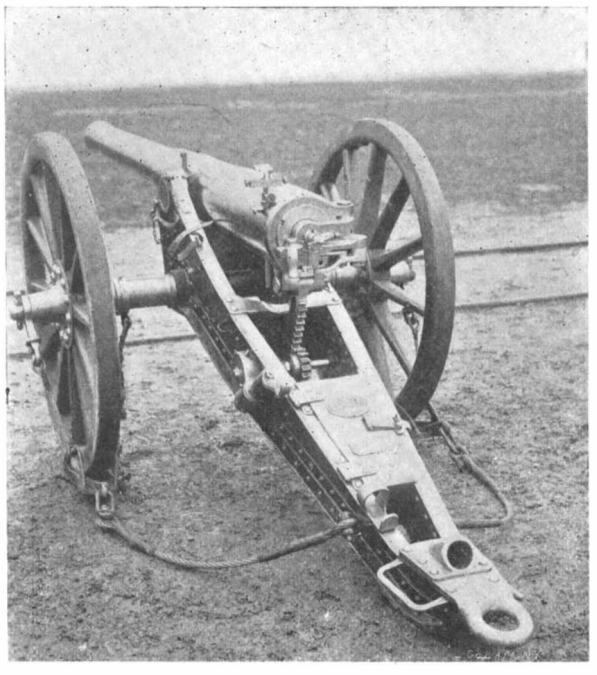
The work of the naval 4.7-inch guns which were unshipped from the "Terrible" and other British men-of-war and provided with ingenious field mountings in order that they might be used to reply to the 6-inch guns of Creusot manufacture within the Boer trenches has been fraught with much interest for students of military science. These naval guns are 16 feet in length, more than twice that of the 15-pounders previously mentioned, and are rifled in twenty-two grooves. These weapons are of the quick-firing type, being capable of discharging ten rounds per minute. They throw a shell weighing 45 pounds by the explosion of a charge of slightly more than 5 pounds of cordite. Telescopic range finders were used in the manipulation of these guns in the field, and they time and again demonstrated their ability to do effective work at 8,000 yards, the ranges frequently exceeding that distance and amounting in some instances to fully 14,000 yards.

In the operations against the Boers as in other conflicts the British authorities manifested great confidence in the howitzers which are also included in the equipment of the field artillery. This weapon is, of course, a short gun, of low velocity, and 5-inch bore. Shrapnel is used almost exclusively, the maximum charge being about 50 pounds. Fifty-pound lyddite shells can also be used in these guns with good results in the bombardment of trenches and fortifications at comparatively close range.

Owing to the character of the country in South Africa, the war against the republics there has afforded exceptional opportunities for a study of the possibilities of mountain guns. The chief arm in use by the British Horse Artillery is a 12-pounder weapon very similar in many respects to the 15-pounder of the field service. The maximum range is 4,000 yards. The approved type of British mountain gun is made in two parts, each of which may be carried on a single pack animal and can be screwed together at short notice. These destructive little weapons may be charged as circumstances may dictate with shrapnel, common or star shell.

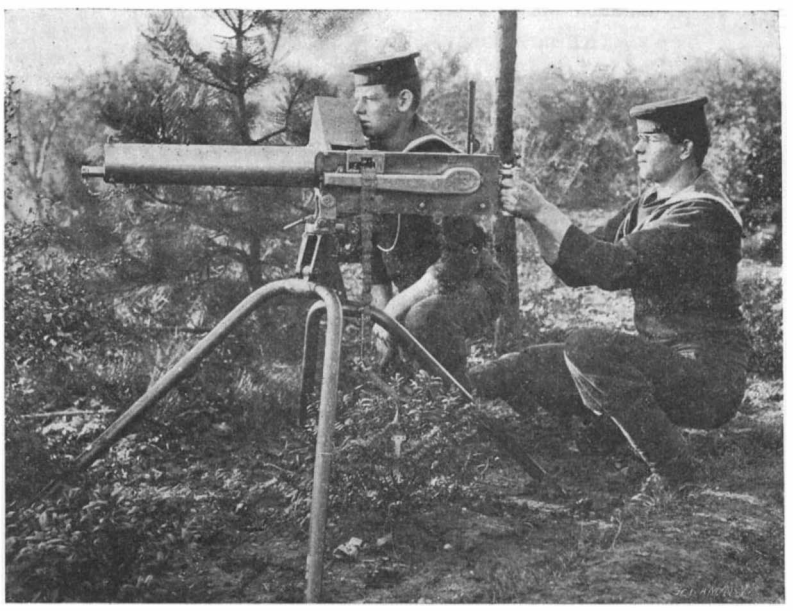
Great Britain has not had occasion to use siege guns to any great extent in any of her military operations during recent years, although a few of the 6-inch breech-loading howitzers which are capable of throwing a 119-pound shell were shipped to South Africa at the outbreak of the war. A weapon which was introduced to some extent in the operations in the Transvaal is the 12-pounder quick-firer, which in general design is identical with some of the naval guns previously mentioned. These guns are thirteen feet in length, weigh considerably more than the 15-pounder in the field artillery and have a range of 10,000 yards with a 12-pound shell.

Whatever may be said of any other grade of ordnance of British manufacture, it must be admitted that the United Kingdom stands in the front rank of nations in the production of machine guns of automatic operation. This was convincingly demonstrated by the display of war material at the Paris Exposition. Such has been the development of the manufacture of weapons of this type within recent years that instead of the automatic principle being confined to guns of rifle caliber we now have 1, 3, 6 and 14-pounder auto-



12-POUNDER NAVAL FIELD GUN.

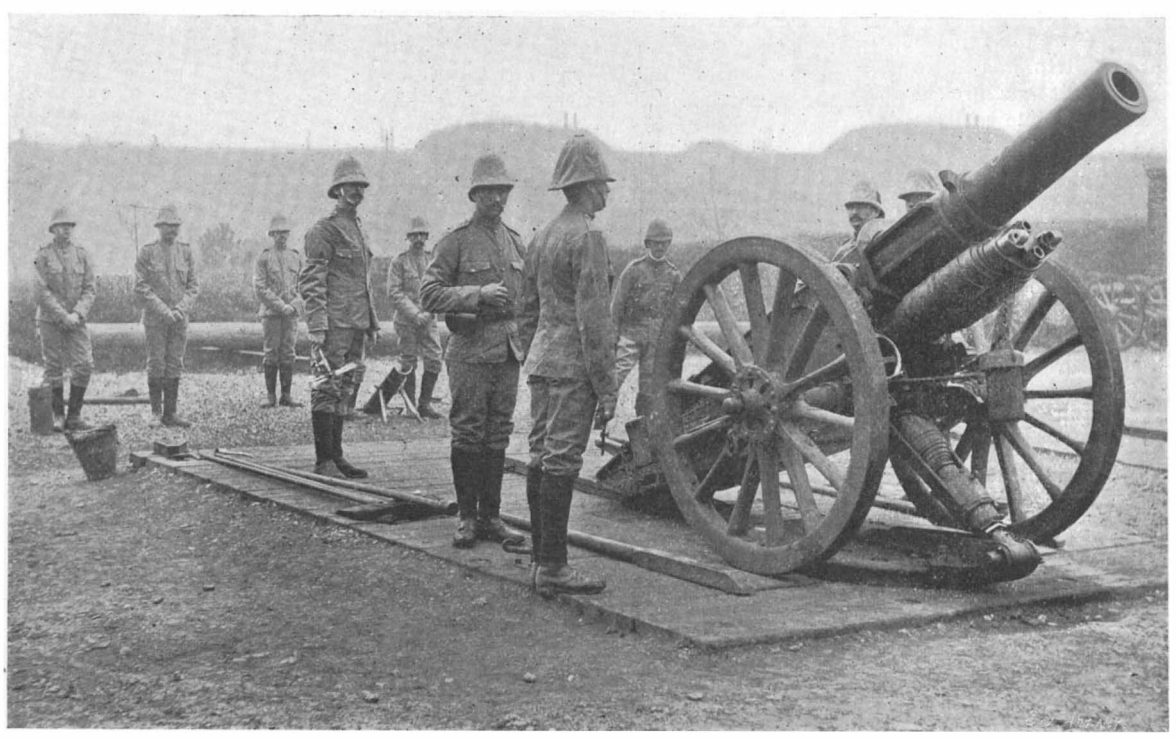
matic fire:s, or Maxims, as they are still designated in some quarters. The 1-pounder, which became famous during the earlier days of the Boer war under the nickname "pom-pom," is capable of delivering three hundred rounds per minute; the 3-pounder, 35 shots; the 6-pounder, 50 rounds; while the 14-pound is capable of delivering 25 shells per minute. The velocity of the projectiles in the cases of these various weapons ranges from 1,800 to 2,500 feet per second, and their destructiveness has been immensely increased by the discovery of the practicability of charging the missiles with high explosives. These heavier rapid-firers are characterized by a similarity of automatic equipment. The breech block instead of being screwed into the breech works in a vertical plane, restricted by guides, and the motive force for the operation of the block is furnished by the recoil of the gun at its discharge. This is accomplished by the compression of a spring which pulls downward a lever connected with the bottom of the block, which in turn actuates a small clip which extracts the cartridge case. The only responsibility resting on the gunner is for the insertion of fresh charges and projectiles. In the "pom-poms," belts of projectiles are provided, and by an ingenious arrangement of levers the successive recoils are made to extract the empty cartridge cases, fix the new charge and fire the gun. In the case of this gun, as will be seen, the gunner's sole task is to train the gun and set the mechanism in operation.



LATEST PATTERN NAVAL MAXIM GUN.

The manufacture of munitions of war under governmental auspices is probably carried out on a more extensive scale in Great Britain than anywhere else on the globe. The ordnance factories employ, all told, close to 18,000 men; pay out in wages nearly $8,000,000 annually, and turn out more than $15,000,000 worth of work each twelve-month. The Royal Gun Factory alone gives employment to 2,400 men whose work consists chiefly of guns of every caliber, and is estimated to represent an aggregate annual valuation of $2,250,000.

While admitting some of the faults cited against their ordnance, the British authorities have laid stress upon its superiority in the matter of mobility. The weight of the 4.7-inch gun, for instance, is when taken together with the carriage but slightly in excess of 5,000 pounds, while the field guns—14-pounders, 6-pounders, 3-pounders and 1-pounders — have respective weights of 2,350 pounds, 1,900 pounds, 1,750 pounds, and 1,150 pounds. The 12-inch gun turned out by the Vickers-Maxim firm has a muzzle energy of 39,843 foot-tons, and the regular British naval gun of that caliber develops 33,020



SIX-INCH HOWITZER, FOR HIGH-ANGLE FIRE.

© 1901 SCIENTIFIC AMERICAN, INC.

foot-tons muzzle energy, as against 30,750 foot-tons by the guns in the French navy and 25,985 foot-tons by the heavy ordnance on the American men-of-war.

MAKING LARGE PLASTER CASTS.

BY J. H. COLLINS.

In the making of monumental sculpture such as that used for the decoration of great exposition buildings or public edifices everything is done on a large scale. The sculptor has for his studio some lofty room with height enough to accommodate figures eighteen or twenty feet tall and space enough for barrels of clay and bins of plaster. He does his modeling from scaffolding and stepladders and thinks nothing of shaping a head half as high as himself or an arm as large around as his body.

The sculptor's first step however, is to fashion a miniature model out of a handful of clay. This is his rough sketch. It serves merely to embody, in a general way, the artist's conception and to present the mass and outline of the composition.

Next in the process comes the construction of a wooden skeleton, heavily made and able to sustain the weight of the clay that is to be laid upon it. For the joints of this skeleton some sculptors use an ingenious iron contrivance which permits change of attitude without loss of rigidity. Sculptor Bock, photographs of whose work illustrate the present article, is the inventor of an adjustable joint for this purpose. This wooden skeleton is adjusted to the desired attitude and braced upon a frame made of two uprights and a crossbar reaching about two-thirds the height of the figure. At this stage of the process everything is sacrificed to strength, as the weight of the clay to be sustained is great. The completed clay model of a single monumental figure sometimes weighs as much as ten tons.

To secure as much lightness as possible it is common to lay a foundation of excelsior and plaster about the wooden skeleton, roughly approaching in form the general outline of the figure. Over this is placed a thick coating of pure plaster indicating yet more clearly the main lines of the figure. This completes what may be termed the core of the model and upon it is laid the wet modeling clay, in huge and almost meaningless masses, to be shifted into form by the sculptor and his assistants.

In taking the plaster mold of the completed model, the first step is to coat the clay all over with soft soap. This prevents the plaster from sticking. Small strips of tin are then inserted upright into the clay, their purpose being to separate and outline the sections into which the mold is to be made. The number and size of these sections depend entirely upon the form of the figure. If the figure is a complicated one, the sections must be numerous and small accordingly. The mold of a simple, erect, draped figure like that in the illustration may be taken in comparatively few sections.

The arms of Mr. Bock's figure, for instance, were molded in two pieces, longitudinally. The head required several sections, while the straight, flowing drapery was made in a few large sections.

A layer of clay is now placed along the edges of the tin strips so that they may be easily located after the plaster has been applied.

Two coatings of plaster comprise the mold. The first is colored with yellow ocher and is applied all over the figure to the depth of about a quarter of an inch. The coloring is to warn the sculptor when the cast has been made and the mold is being chipped away. When his chisel lays bare the yellow plaster, the sculptor knows that the cast is close beneath. The rest of the mold is made of uncolored plaster, which is poured over the figure by the pailful, rapidly and with apparent recklessness. Just before the plaster sets it is braced with strips of wood which not only strengthen the mold, but also serve as handles by which the section of the mold may be removed.

When the plaster has set and before it becomes completely dry—for moist plaster is handled more easily than dry—the tin strips are located and the work of removing the mold in sections is begun. As a rule, the pieces come off easily. Occasionally some deeply-indented portion is removed with difficulty. The front and bottom piece over the drapery in the figure illustrated had to be pried off with a piece of 2 x 4 joist, and it took the combined strength of five men to start it. Even then it was broken at one corner and chipped at the edges. This, however, was easily repaired with a little clay.

When the several pieces of the mold have been removed they are thoroughly cleaned of any clay adhering to them with balls of clay and an application of soap and water.

The figure is cast in sections. The central figure of Mr. Bock's group was made in five castings, the two arms, the head, the torso, and the drapery from the waist down forming each a separate piece.

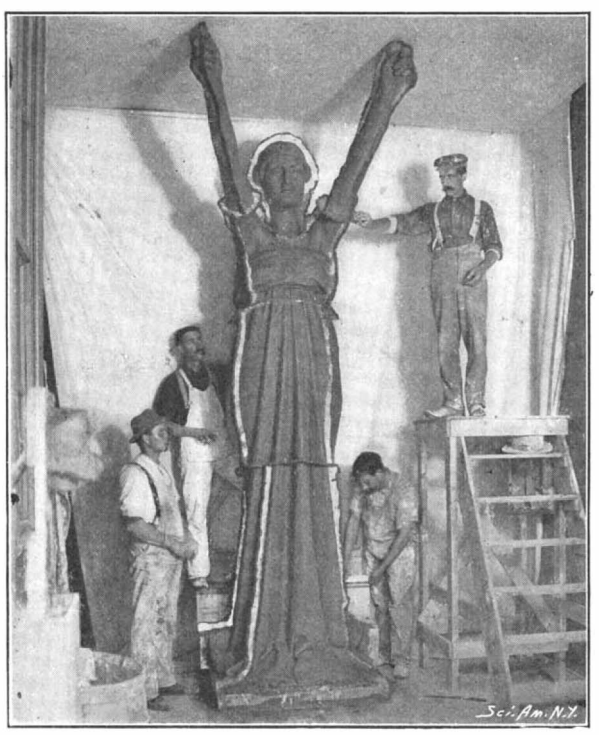
In making the castings, the mold is put together and a thin layer of plaster of fine quality is poured into it and splashed about until every crevice is filled to the thickness of a quarter of an inch or more. As this coating is to be the outside of the completed statue, it may be colored any shade desired. The rest of the cast is made of uncolored plaster mixed with strong hemp fiber. This composition, commonly known as "staff," is applied in successive layers as rapidly as possible until the cast has reached the desired thickness.

The mold is not removed from the cast in sections as from the clay model. Having now served its purpose it may be chopped away with hatchet and chisel, and destroyed. The sculptor and his assistants go about this with a vigor and carelessness which startle the casual spectator. But when the yellow plaster immediately incasing the cast is reached, greater care is exercised, and the final layer is chipped off inch by inch.

When the several parts of the figure have been cast, they are fitted together. Strips of fiber dipped in plaster are used to fasten them together, the strips being placed along the inside seams. On the outside

MODEL OF MR. BOCK'S STATUE OF "PEACE."

THE COMPLETED CLAY FIGURE.



INSERTING THE TIN STRIPS.

THE FIRST PLASTER CAST.

THE PLASTER JACKET.

TAKING OFF THE SECTIONS.

© 1901 SCIENTIFIC AMERICAN, INC.

the seams are pointed with pure plaster applied with a small spatula, and any little imperfection or damaged spot is repaired in the same way.

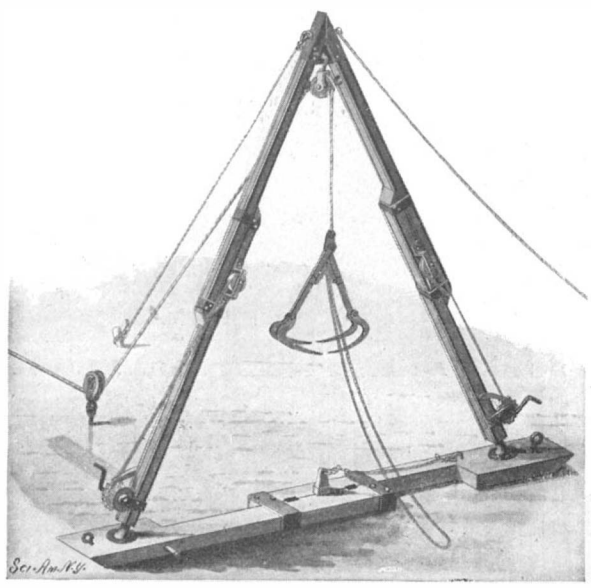
In placing the statue in its permanent place, an iron framework is constructed to give it strength in the same way as the wooden skeleton was used to give rigidity to the clay model.

The final touch is a coat of paint, to give protection from the weather. If the paint is renewed at proper intervals, the plaster statue should last for many years. Work done in this manner a century ago in Europe is still in good repair.

The monumental group "Peace," photographs of which illustrate the process described in this article, is the work of Richard W. Bock, of Chicago, and decorates the arcade of one of the commercial buildings of Minneapolis. The sculptural work on the Chicago, Burlington and Quincy depot at Omaha was also done by Mr. Bock.

A NOVEL HAYSTACKER AND DERRICK.

A patent has been issued to Marvin C. Hutchings, of Bozeman, Mont., which provides a hoisting device to be used as a haystacker, derrick and the like. As our engraving shows, the device consists of a base constructed in adjustable sections locked together by a key which is inserted in one of three recesses formed in the sections. In sockets at the ends of the base sections, side sections having ball ends are received. Thus universal joints are produced. The side sections are composed of sliding members, the upper of which are raised by a ratchet-drum and rope. Forked guy-ropes support the side sections, corresponding members of the forked



A HAYSTACKER AND DERRICK.

portions of the guy-ropes being connected at the same side of the side members and adjacent to each other. A pulley is suspended between the upper portion of the upper members of the side sections; and over the pulley a hoist-rope is carried. Our illustration shows a hay-fork attached to the rope and provided with a trip-rope extending to the ground. The end of the hoist-rope, if it be so desired, may be connected with a sling, a platform, or with any device necessary in hoisting material of different kinds.

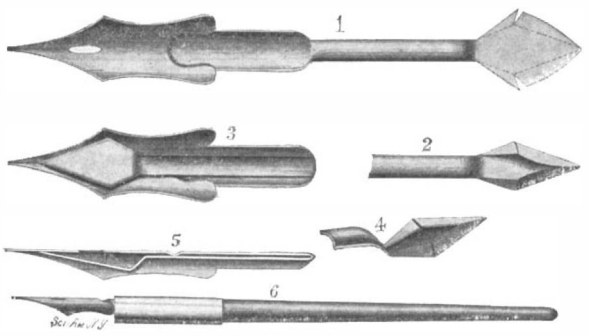
A PEN WITH INCREASED INK CAPACITY.

A new pen which will hold, without danger of blotting, a much larger amount of ink than the ordinary pen, and which can be used in any holder, has been invented by Mr. Clarence E. Fowler, of 118 Center Market, Washington, D. C.

Fig. 1 is a bottom plan view of the blank form from which the pen is made. Fig. 2 is a bottom plan view of the blank bent into shape. Fig. 3 is a bottom plan view of a complete pen. Fig. 4 is a detail perspective view of a reservoir formed by the bent-up blank. Fig. 5 is a longitudinal section of a complete pen. Fig. 6 shows the pen attached to a penholder.

The invention seeks to provide a pen having an integral underlying reservoir, so formed and arranged that it will in no wise interfere with the desired flexibility of the pen. The shank of the pen as shown in Fig. 1 is formed integrally with a second long shank carrying at its outer end a blank which is to be bent on the dotted lines of Fig. 1. When thus bent the blank assumes the form shown in Fig. 2. The reservoir thus formed from the blank is then bent down to lie snugly within the shank of the pen as shown in Figs. 3 and 5, the shank of the pen and the shank of the blank being oppositely curved so that one will lie within the other (Fig. 5). The double shank produced can easily be fitted within an ordinary pen-holder (Fig. 6). At its juncture with the reservoir, the long shank is given a downward bend (Fig. 4) which holds the rear end of the reservoir away from the body of the pen and affords space at either side of the rear end of the reservoir for the entrance of ink. The entrance of ink is also facilitated by tapering the struck up portions of the blank as shown.

The apex of the diamond-shaped reservoir lies with the apex contiguous to the slit of the pen and extends just past the eye. Thus the reservoir operates to feed the ink to the point. The peculiar form of the reservoir exposes but a small surface of the ink



THE FOWLER PEN.

to the air. Experience has shown that the ink does not run out when the pen is laid down by reason of the adhesion.

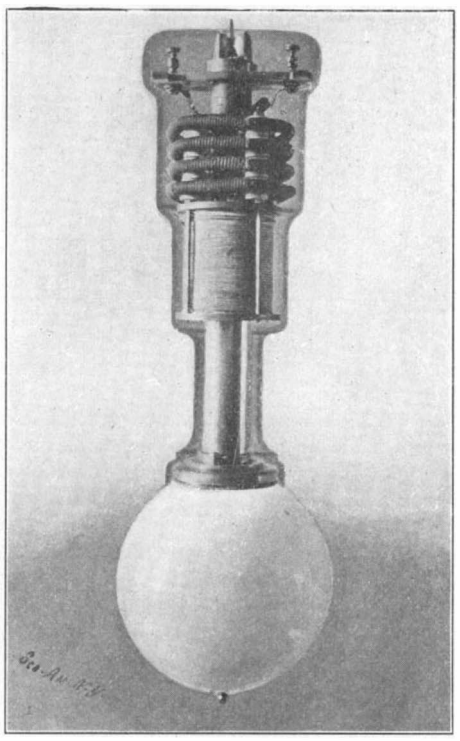
A COMPLETELY INCLOSED ARC LAMP OF SMALL SIZE.

A well-conceived, excellently designed lamp has been patented by Mr. Gustav Rasmus, of 239 Winan Street, Long Island City, N. Y., which is remarkable for its great efficiency and compactness.

The lamp comprises a frame supporting a resistance-coil, connected at one end with a leading-in wire and at the other end with a central metallic tube capped by a hood. Within the frame is a solenoid, comprised in the circuit and designed to operate the upper carbon. Extended through the solenoid is a brass tube in which a tubular core operates, which core is rigidly connected with an inner tube within which the upper carbon is located. The upper end of the carbon is held in a socket. The lower end of the upper carbon passes through two plates insulated from each other and carried by the outer brass tube. A central hub on the lower plate carries a threaded ring by which the globe is so supported that the carbons are completely inclosed, as our illustration shows. The lower carbon is mounted in a socket carried by the globe itself—a feature not to be found in other lamps.

When the current is cut out momentarily the upper carbon will move downward in contact with the lower carbon. Clamping devices by which the upper carbon is normally held will then momentarily release the carbon. When the current is closed, the solenoid is energized, drawing the core up and causing the clamping devices to engage and raise the upper carbon to form the arc.

The merits of this construction are obvious. Only one solenoid and one resistance-coil are used. An efficiency of 90 per cent is claimed for the lamp. No valve is used. The arc is entirely inclosed, so that when the oxygen has been consumed, the carbon burns slowly away in an atmosphere which is void of oxygen.



THE RASMUS ARC LAMP.

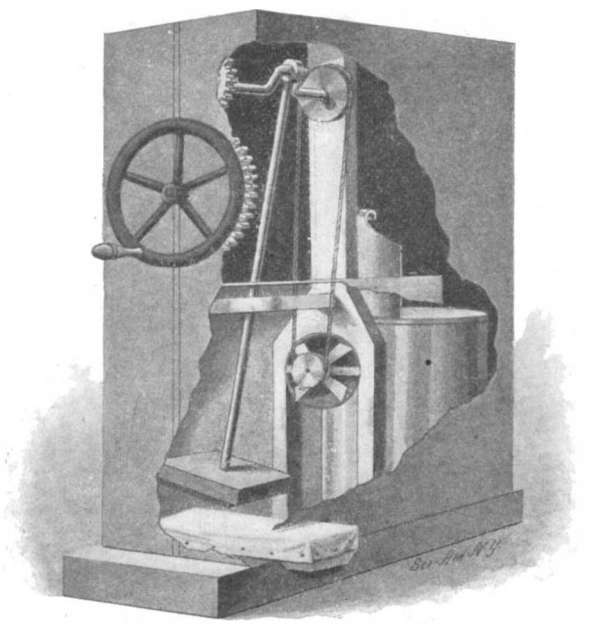
With a current of 4½ amperes and a difference of potential of 110 volts, a soft, uniform light of 1,000 C. P. is maintained. Although the lower carbon is 5 inches and the upper carbon 12 inches long, the full length of the lamp is not quite 20 inches. By mounting the lower socket directly in the globe, no shadow is formed. A sheet of white paper held horizontally below the lamp at a distance of 1½ inches or in any position beside the globe will reveal no shadow. The usual difficulty of securing a uniformly-distributed shadowless light being thus overcome, the inventor found that he could readily construct a compact arc lamp which had a life of 55 hours, and which could be readily fitted in an ordinary incandescent bulb socket. This miniature arc lamp is but ten inches long, has a candle power of 320, and uses the same current as four incandescent lights, which ordinarily give but 64 C. P.

A MACHINE FOR CLEANING BLACKBOARD ERASERS.

Among the patents recently granted in the United States is one issued to Terrence McSpirit, of 97 Beebe Avenue, Long Island City, for a machine for cleaning blackboard erasers.

In an inclosed upright frame a crank-shaft is journaled, which is turned by a crank-wheel through the medium of gearing. A rod is carried by the crank of the shaft, to the lower end of which rod a beater is secured. The rod and beater operate in a casing provided with a removable extension. A collar on the extension receives a fan driven from the crank-shaft by a belt and pulley.

The eraser to be cleaned is placed face upward in the base of the machine below the beater. As the handwheel is turned, the beater rises and falls and strikes the cleaning-surface of the eraser. The beater has also a lateral reciprocating motion, so that at each stroke of the rod the beater, after striking the cleaning-



A BLACKBOARD-ERASER CLEANING-MACHINE.

surface of the eraser, tends to force the eraser out from the machine a given distance. The dust beaten from the eraser is blown by the fan into the extension previously mentioned. When the extension is to be cleaned, the collar containing the fan is closed by a slide, and the extension, or that portion of the casing containing the extension, removed.

Acetylene Gas vs. Petroleum in Germany.

Up to the present time Germany has imported each year from $25,000,000 to $30,000,000 worth of American petroleum. This industry, however, seems to be threatened somewhat by the introduction of acetylene as an illuminant, in a convenient and safe form, for house, store, and other uses. This has resulted from the low price at which calcium carbide is being produced there, and also from the rise in the cost of petroleum in the German market.

The Current Supplement.

The current Supplement, No. 1320, is unusually interesting. "The Function of Hand Work in the School," by Prof. Charles R. Richards, is elaborately illustrated by ten engravings made from the actual objects. "Grisson Gearing" describes a new method of mechanical transmission. "The Influence of Submarine Cables upon Military and Naval Supremacy" is by Capt. Geo. O. Squier, U. S. A., and is a very full article. "Electrical Oscillation and Electric Waves," by Dr. J. A. Fleming, is concluded. "The Improved Hughes Printing-Telegraph" describes the latest form of this apparatus. The usual "Trade Notes and Receipts," and "Selected Formulæ," etc., are given.

Contents.

(Illustrated articles are marked with an asterisk.)

Acetylene gas vs. petroleum.... 250
Arsenic in hair.... 244
Automobile news.... 247
Blackboard eraser*.... 250
Bridge construction, the new East River*.... 241, 246
Bullets, explosive effects of.... 247
Canal muddle, Erie.... 242
Casts, making large plaster*.... 249
Chemical compounds, new.... 242
Cotton industry, local conditions favorable to.... 243
Cruisers, armored.... 247
Electrical notes.... 247
Eraser cleaner, blackboard*.... 250
Glass industry, new products in.... 242
Grazing pen, movable*.... 244
Gyroscope, electrical*.... 245
Haystack and derrick*.... 250
Inventions, index of.... 252
Inventions recently patented.... 252
Lamp, arc*.... 250
Naval construction, American.... 247
Notes and queries.... 252
Ordnance, modern British*.... 248
Pen, improved*.... 250
Phonograph records, duplicating.... 242
Science notes.... 243
Steamers, stern-wheel*.... 244
Storms, detection of by coherer.... 242
Supplement, current.... 250
X-ray work, present state of*.... 245

© 1901 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

MOWER ATTACHMENT.—WILLIAM A. SANDER, Jackson, Mo. The inventor has provided a divide-bar or arm detachably connected with the outer shoe and slide of the machine, and made to extend upward and forward. The purpose of this bar or arm is to divide hay, clover, or other grasses, and especially tangled grass and stock peas, the divide-bar serving to guide the material to be cut down to the cutting surface of the sickle, thereby making a smooth, clean swath.

Engineering Improvements.

STEAM-GENERATING EXPLOSION-ENGINE.—LOUIS RENAULT, Place de Laborde 14, Paris, France. The inventions consist of an auto-generating apparatus, for gases or steam: that is to say, an apparatus by means of which it is possible, without the use of either a compressor or a burner, to obtain a mixture of heated gases from the cylinder of an explosion-motor and of steam produced by utilizing the heat obtained on the one hand from the wall of the cylinder, and on the other hand from the heated gases which escape therefrom. A portion of these gases is made to circulate in contact with the free surface of the mass of water to be vaporized. The mixture is intended to be employed in a motor, steam turbine of any kind, or other apparatus in place of steam generated in the ordinary manner.

Mechanical Devices.

FRICTION-CLUTCH.—ANTON LEIKEM, Chicago, Ill. The clutch has a driven part; a pulley to be driven and provided with friction faces and notches; and friction-blocks on the driven part, engaging the face. An operating device moves the friction-blocks in or out of engagement with the friction-face. A locking device controlled by the operating device is arranged positively to lock the pulley to the driven part when the blocks slip on the face. Thus the pulley is positively locked to the driven part should the friction-blocks slip under a heavy load.

CAN FORMING AND SOLDERING MACHINE.—WILLIAM RUBIN, Omaha, Neb. The purpose of this invention is to provide means for forming the bodies of tin cans and for soldering the side seams. To this end the apparatus comprises a number of continuously-moving carriers, which shape the blank tin to form the can or box, and which form a lap seam. This seam is carried through a solder-bath without interrupting the movement of the carrier. Thus the seam is closed. After the solder has been allowed to set the can is automatically withdrawn.

BARB-WIRE REEL AND CARRIER.—CHARLES J., JOHN P. and HENRY M. THOMAN, Riverside, Iowa. This new and improved machine for reeling, unreeling and stretching barb-wire, check-row wire and the like, is lightly and durably constructed, and carries the wire bobbin on a drum or reel which is operated by simple mechanism. The machine comprises essentially a wheel-supported frame; a shaft for the reel; a bearing for one end of the shaft having a hinged connection with the frame; a bearing for the opposite end of the shaft open at its upper portion, and a drive-shaft. A gear connects the drive-shaft and the reel-shaft. A brake controls the movement of the drive-shaft when the wire unreels too easily.

MACHINE FOR ROLLING LEATHER.—WILLIAM W. WHITING, Newberry, Pa. The machine rolls leather for the purpose of rendering it of uniform density and of giving it smoothness. The machine is simple in construction, readily adjustable to different thicknesses of leather and is provided with an arrangement for securing an automatic leveling of the pressure-exerting surface in accordance with inequalities of the material.

STREET-SWEEPER.—JOAQUIN JENÉ, Buenos Ayres, Argentina. The invention provides a sweeper carrying a propelling engine and means for sprinkling the streets and gathering the sweepings into a receptacle, so that the machine may be termed an "automobile combined street-sweeper, sprinkler, and dirt-cart." A conveyer is arranged to gather the sweepings and to carry them to the dirt-receptacle. The conveyer consists of blocks having projections overhanging toward the delivery end of the conveyer. Links or side-plates are pivoted to the blocks to form a chain, and have cross plates to support the sweepings. The conveyer is actuated by the motor of the vehicle.

POWER-TRANSMITTING DEVICE.—FERDINAND CLEMENS, JR., Delta, Iowa. This device is especially designed for operating pumps, saws, washing machines, churns, or other machines or devices. The device comprises a driven wheel having a scalloped periphery. Each lever or sets of levers and links carries an anti-friction roller traveling on the peripheral surface of the wheel, the links being connected with the levers. Sets of actuating-levers are connected with the machinery to be driven, and are engaged by the links. A counterbalancing device is provided for one of the levers.

POWER MECHANISM.—FERDINAND CLEMENS, JR., Delta, Iowa. In this power mechanism a walking-beam is employed to which an arm is secured, connected with a link. A lever is pivoted to the link. A wheel has friction-rollers successively engaging the free end of the lever. A bumper-block on a bumper limits the return stroke of the working parts. Like the invention previously described, this power mechanism is designed to actuate pumps, churns, washing-machines and the like, and is arranged to give a large number of strokes for one full turn of the sweep or crank-arm.

Vehicles and Their Accessories.

DUMPING-WAGON.—ERNST MÜLLER, Bronx, New York city.—This invention is a dumping-wagon which has been constructed with certain novel features tending to improve the manner of framing the bed of the wagon and of mounting the dumping-body. The bed comprises longitudinally-extending side-beams. Under the bed a front axle is mounted. Brackets are attached to the rear portions of the side-beams and extend forward. In the brackets a rear axle is carried. Between the brackets a shaft extends rigidly, on which a tube is mounted to turn. The dumping-body bears on the side-beams, and is mounted on the tube. The weight of the body is evenly distributed throughout the various parts of the wagon, so that great loads can be carried without danger.

TRUCK.—JOHN J. MOULE, Stockton, Cal. The truck is mounted on five central transversely-alined rollers, and is provided at either end with swinging propelling devices. Upon rocking the forward end of the truck frame downward, the forward propelling device, by engaging with the ground, will act to aid the truck in its upward and onward movement. While this forward end is being rocked upward the rear end will be moved downward, so that its propelling device may move into operative engagement with the ground. The propellers act as levers.

VEHICLE-AXLE.—JOHN P. COUNCIL, JR., Wananish, N. C. The axle-spindle devised by Mr. Council has a simple means for the supply of lubricant and for causing the oil to move by gravity to the outer side of the spindle and distribute itself evenly. A simple means is likewise provided for removing dirt or grit which may enter around the inner end of the spindle. The axle will be introduced by the White Patent Axle and Hub Company, of Wilmington, N. C.

Railway Contrivances.

CAR-LOADER.—SAMUEL E. KURTZ, Sac City, Iowa. This invention relates to improvements in devices for loading grain into carts. The loader comprises a platform over which an endless chain moves. Scraper-blades are attached to the chain and have notches at the under edge for the reception of a longitudinal guide-strip. The loader is suspended diagonally from the ceiling of a car, with its receiving end projected through the doorway. The grain is delivered from an elevator through a flexible chute which delivers the material between side pieces connected with the sides of the loader. The material falling from the conveyer will first drop into the car near the doorway. Then, as the grain is stacked up at each side, the car fills gradually toward the other end. The loader is thereupon placed in the opposite end of the car, which is similarly loaded. The loader has a capacity of about 2,000 bushels per hour if operated by hand, and about 4,000 bushels per hour if operated by an engine.

Miscellaneous Inventions.

NECKTIE-HOLDER.—ISAAC STEINAU, Manhattan, New York city. The necktie-holder is to be applied to the back of a collar, so as to straddle the back collar-button. The holder is held in position by frictional engagement with the collar. The band of a necktie placed in contact with the outer face of the fastener is held against lateral and vertical movement.

DEVICE FOR USE IN EXTRACTING ASHES.—ERNEST C. COLE, 3218 Western Avenue, Chicago, Ill. The device comprises a canopy or shield for application to the mouth or entrance of the ashpit of the stove, and fits over the vessel placed to receive the ashes so as to prevent the dust from escaping into the room.

FASTENERS FOR DOORS OR WINDOW SCREENS.—JOSEPH W. LYONS, 270 Block I, Pueblo, Colo. The invention is an improvement in doors and window screens, and provides means for securing the doors and screens in place in such a manner as to retain them firmly in position and to prevent their warping. The frame of the screen has an open longitudinal groove or recess in which a shaft is fitted, provided with catches and with an operating lever. A spring operates upon the lever to actuate the shaft. Plates have slots for the lever and catches, and are fitted thereover and over the groove or recess and secured to the frame.

HEATER FOR BEDS AND FEET.—EDWIN T. KEENER, Delaware, Ohio. The inventor has devised a novel form of heater adapted to be secured to the footboard of a bedstead or the sides, or both. The heating device consists of a drum with a depending hood, into which the heat from a lamp or other heating means passes. The device is so constructed that no danger is incurred.

FASTENING FOR FIXTURES.—JOHN KRODER, 31 Union Square North, Manhattan, New York city. Mr. Kroder has invented a fixture for the many curtain-poles which he has devised, and for other fixtures as well. By means of this new and improved fastener the head or tip is securely held in position on the rod in a very simple manner without the use of solder rivets, or similar means.

TROUSERS-STRETCHER.—WALTER H. SHINDLER, West New Brighton, N. Y. The inventor has devised a stretcher which will press, crease, and stretch trousers, and hold them for any length of time extended. The device is so constructed that it may be suspended from a support or lie upon a support, and that it may be compactly folded when not in use.

DOOR-CHECK.—GEORGE STUBBS, Perth, Western Australia. The door-check comprises a check-bolt carried by a spring-pressed rod at one end. A lever is pivoted to the other end of the rod, and is capable of sliding on its fulcrum. Means are provided for holding the lever in locked position when the check-bolt is withdrawn against the tension of the spring of the rod. The operator can immediately bring the check into action to hold the door in an open position and to permit its being moved into an inactive position when it is desired to open or close the door.

FASTENER.—RALPH APPLEBOM and JOE SIDENBITEL, Dallas, Texas. The fastener will hold almost any article in position, from a scarf or tie to a portière or trunk. The inventor, however, employs his device especially in connection with neckties and bows.

OIL-BURNER.—CASPAR BLUMER, Manhattan, New York city. The burner uses crude petroleum as fuel without danger of explosion, either at the burner itself or at the supply pipes leading to the burner. One of the novel features of the device is to be found in the construction whereby the level of the fluid in the reservoir which supplies the burner and its connecting-pipes, or the top of the reservoir itself, is below the fire-line of the burner, although the reservoir may be remote from the boiler.

HAT AND COAT HANGER.—FRANK MAREK, JR., Summit, N. J. By using a single piece of wire, bent to form hooks, the inventor has provided a very simple and economical support which has considerable rigidity.

ARTIFICIAL HAND.—ALBERT C. MUELLER, Wausau, Wis. In this artificial hand the thumb and fingers are operated by means of a screw, arranged to be turned upon the rotation of the forearm. Springs are employed to return the fingers to their normal or open positions.

KEYBOARD-COVER FOR TYPEWRITING-MACHINES.—CLARA P. SEIPPEL, Chicago, Ill. The invention provides a cover for the keyboards of typewriting machines, especially adapted for use in the teaching of "touch" typewriting, or the manipulation of the keyboard while it is concealed. The keyboard-cover is not an obstruction; for the machine can be operated with perfect freedom. The cover is composed of any suitable fabric, and is supported on a spring-frame attached to the machine.

MOLDING FRAME OR BOX.—LEON TILLET, Vrigne-Aux-Bois (Ardennes), France. Molding frames or boxes are usually joined together by means of fixed pins. The construction is costly and inefficient. To permit the more precise joining of the boxes, the inventor molds on each part of the box or frame, projections and recesses of variable form and dimensions, corresponding to the parts of the box. These projections and recesses being formed when molding, the parts are always identically the same both as to dimensions and positions.

PROCESS OF MAKING LUBRICANTS.—MILLARD S. HUDNALL, Wichita Falls, Tex. The process consists in adding signal-oil to slaked lime, until the lime emulsifies, then adding black oil, heating the mixture, and finally pouring into it a hot soap solution. The lubricant is of great efficiency for cooling hot boxes, journals, and other parts of machinery, and for preventing the heating of such parts.

CASING-ELEVATOR.—JAMES J. DAVIN, Washington, Pa. The ordinary casing elevator consists of a collar made of two sections hinged together, a bail attached to the hinged side, and a bail attached to the opposite or free side, with which a locking-link is connected, and is designed to drop into a notch. When the casing hook is adjusted a lost motion takes place. As the hoisting-engine is started the lost motion is taken up and a horizontal swaying is started. During the swaying motion the front bail causes a different center for the strain to be found, and one side of the casing-collar bears all the strain or pulls off the casing. These dangers and difficulties are overcome by Mr. Davin by so constructing the parts that the bail cannot become locked in its outer position: but the swaying motion is permitted to continue until stopped by gravity.

Designs.

PRINTING-FILM.—BENJAMIN DAY, West Hoboken, N. J. The printing-film which forms the subject of this design has been previously patented by Mr. Day in another form. The printing-film, in the present instance, has a particular irregular arrangement of dots. In certain portions these dots are closer together than in others, so as to present a grading effect or shading. The film is to be used in photography for producing certain effects.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send your name and address to the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 414.—For manufacturers of ice plants.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 415.—For metal checks for checking baggage.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 416.—For manufacturers of brass head nails of a fancy design like a rosette or fleur de lys.

Motor Vehicles, Duryea Power Co., Reading, Penn.

Inquiry No. 417.—For small novelties for itinerant venders.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 418.—For manufacturers of portable cottages.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 419.—For the manfacturer of the "Pearson" lifting jack.

La Porte Watch School, La Porte Ind. Catalogue free.

Inquiry No. 420.—For parties to make brass machine screws and nuts with hollow core, in quantities.

Dies & Special Machinery. Amer. Hdw. Mfg. Co., Ottawa, Ill.

Inquiry No. 421.—For a lathe for making broom handles.

Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

Inquiry No. 422.—For manufacturers of brick machines.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 423.—For manufacturers of rubber and metal hair pins.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 424.—For water motors suitable for driving a 4-inch lathe with ordinary house service pipe.

Our number 4 Catalogue of Automobile parts, write us, Standard Welding Co., Cleveland Ohio.

Inquiry No. 425.—For manufacturers of inside Venetian blinds and "ladder tapes" necessary for their manufacture, and also for pulleys for these blinds.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 426.—For manufacturers of the common, spring friction clutch, as applied to transom openers, etc.

SAWMILLS.—Variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 427.—For a refrigerating machine connected to an electric current, causing the cooling process to be carried on automatically, to be stopped and started by a switch.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 428.—For manufacturers of non-refillable bottles.

Gear Cutting of every description accurately done. The Garvin Machine Co., Spring and Varick Sts., N. Y.

Inquiry No. 429.—For manufacturers of Washita oilstones, farriers' whetstones, hones in boxes, scythe rubstones and grindstones, troughs and fittings.

Rester Electric Mf'g Co's, Self-fluxing solder saves labor, strong non-corrosive joints, without acid, Chicago, Ill.

Inquiry No. 430.—For the present address of the Frost Lock Fencing Co. or the Frost Wire Fencing Co.

Marble dust for sale. W. A. Heaphy, Lee Mass.

Inquiry No. 431.—For small balls for ball-bearings made of glass or porcelain.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 432.—Wanted, outfits and materials for making rubber stamps.

For Sale.—Right to take out foreign patents on my invention, Suspender End Attachment, U. S. patent to issue May 4, 1901. Address C. H. Dome, Prescott, Ark.

Inquiry No. 433.—For goods suitable for the mail order trade.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 434.—For manufacturers of small rotary engines of moderate horse power.

Sheet Metal Novelties, Articles and Stampings of all sizes. Tools and dies manufactured on contract. Address Standard Stamping Co. Cor. 7th & Hudson Sts., Buffalo, N. Y. U. S. A.

Inquiry No. 435.—For information concerning the Hornsby-Ackroyd gas or gasoline engine.

Wanted.—Skilled artist in mechanical art work. No one need apply who has not a knowledge of mechanics coupled with artistic ability and experience. Address Artist, P. O. Box 773, New York.

Inquiry No. 436.—For manufacturers of brass camera trimmings.

A Novelty—Neat, Ingenious and Practical.—Nickel-plated pocket implement useful in eighteen distinct ways; postpaid on receipt of 75 cents in U. S. stamps. Emil Schleusner, Bonn, Germany.

Inquiry No. 437.—For manufacturers of small gasoline engines about one-sixth b. h. p., also punchings for small dynamos.

Government Relics—guns, swords, revolvers, saddles, cannons, etc, from Goverment Auction are now being sold at ridiculously low prices. Send for illustrated lists. Francis Bannerman, 579 Broadway, N. Y.

Inquiry No. 438.—For manufacturers of gasoline generators for heating and lighting purposes.

A Winton motor carriage, model 1899, for sale. Price, $500 f. o. b. cars Syracuse. This machine is in good running order, and was run less than 500 miles. Address, William Schmidt, 339 East Genesee St., Syracuse, N. Y.

Inquiry No. 439.—For manufacturers of perforated films for making moving pictures, also manufacturers of machines for taking moving pictures.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 440.—For manufacturers of tin can machines.

© 1901 SCIENTIFIC AMERICAN, INC.

Inquiry No. 441.—For manufacturers of pasteboard cans for baking powder.

Inquiry No. 442.—For manufacturers of insulated wire.

Inquiry No. 443.—For machinery for the manufacture of brickets as fuel.

Inquiry No. 444.—For manufacturers of patent novelties of malleable iron castings, also parties to line same with porcelain.

Inquiry No. 445.—For manufacturers of slot machines, such as scales, moving pictures, etc.

Inquiry No. 446.—For machines for cutting tobacco for making cigarettes; the tobacco to be granulated.

Inquiry No. 447.—For information concerning machines for rolling cigarettes. The paper is straw paper, not gummed, but turned in at the ends.

Inquiry No. 448.—For manufacturers of steel spiral belting and small spiral springs.

Inquiry No. 449.—For manufacturers of viscose and like substances.

Inquiry No. 450.—For manufacturers of electric cigar lighters; the overhead form suspended by conducting cords preferred.

Inquiry No. 451.—For parties to manufacture a brand-new machine much in demand.

Inquiry No. 452.—For manufacturers of hand sewing machines, usually sold as useful toys.

Inquiry No. 453.—For parties to make sheep calls to be used in a wolf trap.

Inquiry No. 454.—For manufacturers of cow milking machine.

Inquiry No. 455.—For rubber balloons of about one meter in diameter.

Inquiry No. 456.—For dealers in silk-worm gut for use in fishing tackle.

Inquiry No. 457.—For manufacturers of machines for making fish nets.

Inquiry No. 458.—For manufacturers of peat-pressing machines.

Inquiry No. 459.—For parties controlling plants for the manufacture of peat into paper.

Inquiry No. 460.—For manufacturers of outfits for canning factories.

Inquiry No. 461.—For the manufacturer of the outfit known as "The Home Canner."

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8160) H. P. asks: 1. At what degree of heat do cast iron, steel, platinum, brass, and wrought iron become cherry red; also degree at which they fuse? A. The metals you name become cherry red at 1,400 deg. F. Cast iron melts at 2,250 deg.; steel, 2,500 deg.; platinum, 3,500 deg.; brass, various, 1,400 to 1,600 deg.; wrought iron, 2,700 deg. 2. Is there any other metal or alloy that will stand more heat than the foregoing? A. There is no available metal that will stand more heat than platinum.

(8161) C. W. C. asks: Will you explain how the earth can be proved to rotate on its axis by the use of the pendulum? A. If a ball of lead or other heavy metal be hung by a long wire from a firm support, it may be swung as a pendulum and will maintain its swing in the same plane in space, independent of the earth. Such a ball hung over the north pole would swing toward the same point of space as long as it continued to swing. If it could swing for 24 hours it would swing toward all points of the horizon during that time, because of the rotation of the earth. In our latitude the south end of the swing will deviate from a north-and-south line about 9 deg. an hour. A ball of lead of 20 pounds' weight, hung by a piano wire 40 feet long and set swinging in a north-and-south direction, should show the deviation in ten minutes. This could not be, if the earth were not turning on its axis from west to east. To set the pendulum swinging, tie a thread to the ball, draw the ball back as far as desired, and tie the thread to some convenient support. When the vibrations of the ball have died out, burn the thread with a match, and the pendulum will begin to swing without any jar or other inequality in its motion, which would cause the pendulum to swing in other than a straight line back and forth, and ruin the experiment. This experiment was first performed by Foucault in Paris at the Pantheon, but has since been repeated in many places. See Supplement No. 627, price ten cents.

(8162) E. E. B. says: The fact that I have been a subscriber and reader of the Scientific American for the past 23 years is the only excuse I offer for the following question. On page 515 of appendix of a work entitled "Buried Cities Recovered, or Explorations in Bible Lands," by Frank S. DeHaas, D.D., fifth edition with appendix, published by Bradley, Garrettson & Co., Philadelphia, in 1884, I find stated that a Mr. Rassam has discovered at the remains of the antediluvian city of Balawat, in the Euphrates Valley, a stone or terra-cotta chest containing tablets of antediluvian history written by Noah. Is this statement true? A. Nothing has ever been found which was written by Noah. We scarcely can expect to find anything belonging to his period. There have been found, however, cuneiform tablets recording the stories of the Creation, Deluge, erection of Babel, etc., written by the Babylonians and translated in Assyrian. These record very closely resemble the Biblical account as recorded in Genesis. If you are interested in the subject, you can secure a book recently published, "The Monuments and the Old Testament," by Ira M. Price, published by the Christian Culture Press. The price is about $1.25. Another work on the subject is "The Higher Criticism and the Monuments," by A. H. Sayre.

(8163) O. B. M. asks: Will you kindly inform some of your readers if the modern incandescent gas light is injurious to the eyesight, or unfit to work by at night, as draughting, using colors, etc.; also as to best light globes, shades, etc.? A. The incandescent gas light cannot be any more injurious to the eye than any other light of equal brightness. It should not be used near to the eye without a shade. All artificial light is injurious to the eye, if improperly used. The practice of the fathers to go to bed at dusk, or, at any rate, to sit with the light of the fireplace only, was better for the eye than our manner of turning night into day. An opal shade is the best white shade for any lamp, which is used for lighting a large space like a drawing board.

(8164) M. H. asks: What is a telephonograph? I would like to know where they are offered for sale, and at what prices, and the differences between them and the ordinary concert phonographs with the extra large wax cylinders? A. The telephonograph is a very different instrument from the ordinary phonograph. It has been the subject of several articles in the Supplement, under the name "Telegraphone." See Supplement Nos. 1286 and 1307, price ten cents each. The instrument has no wax cylinder, no style to scrape along the indentations made for it, and is said to reproduce the sound with a perfect preservation of its quality without any metallic or harsh tones added. We do not think it is yet for sale in this country.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

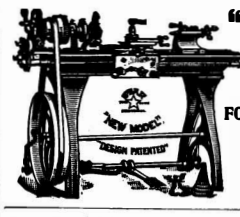
APRIL 9, 1901,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, producing acetylsalicylic, L. Lederer. 671,769
Advertising or displaying device, luminous, J. T. F. Conti. 671,538
Air motor, liquefied, O. P. Ostergren. 671,608
Alloy, J. E. Hewitt. 671,595
Ammunition box, H. W. Daly. 671,817
Animal trap, G. Malling. 671,524
Annunciator, D. Rousseau. 671,776
Assay furnace, D. Laird. 671,558
Automobile gearing, F. L. Dyer. 671,721
Automobile vehicle, Warren & Hoffman. 671,532
Automobiles, variable speed reversing drive for, W. L. Judson. 671,673
Axle boxes, temperature alarm and indicator for car, R. G. Callum. 671,813
Axle, lubricating, F. P. White. 671,847
Bags, etc., securing device for, S. P. Grant. 671,589
Bailing press, H. L. Duncan. 671,918
Bailing press, W. R. Coleman. 671,940
Band cutter and feeder, S. Bufkin. 671,581
Bars, etc., mechanism for shifting and separating, S. V. Huber. 671,440
Bath tub heater, G. D. Robertson. 671,868
Bed bottom support, L. W. Welch. 671,843
Bed, box sofa, C. Buhner. 671,906
Bell, E. D. Rockwell. 671,924
Berth, ship's, H. Kaiser. 671,767
Bicycle brake, C. K. Davis. 671,435
Bicycle changeable gear, safety, J. W. Cromer. 671,945
Bicycle dress guard, L. D. Cooley. 671,816
Boat, life, C. F. Sultemeyer. 671,502
Bobbin holder, J. E. Bacon. 671,744
Boiler. See Steam boiler, Water tube boiler.
Boiler tube sheet, J. C. Spiers. 671,782
Boilers, automatic regulator for steam, R. Janney. 671,598
Bolt. See Lock bolt.
Bolt holder, H. Stade. 671,872
Bolt pointing machine, C. Lanz. 671,522
Booster crusher, Pfatischer & Bedell. 671,489
Boot or shoe, J. E. Jackson. 671,518
Bottle attachment, ink, L. Schoen. 671,779
Bottle closure, A. W. Weber. 671,784
Bottle, glass, R. J. Kirkland. 671,649
Bottle, non refillable, F. B. Hooper. 671,597
Bottle, non refillable, C. A. Stewart, Jr. 671,735
Bottle, non refillable, A. Brielmayer. 671,753
Bottle, non refillable, E. T. Evans. 671,880
Box, J. Selle. 671,897
Box cover, auxiliary, M. Meyer. 671,833
Brake apparatus, J. E. Anger. 671,787
Brake beam, P. T. Handiges. 671,552
Brake beam, J. H. Baker. 671,745
Brake beams, apparatus for making metallic, T. E. Carliss. 671,537
Brake beams, making metallic, T. E. Carliss. 671,536
Brake block, G. Gumpel. 671,860
Bridge superstructure, R. Petersen. 671,923
Brush, W. A. Eldredge. 671,722
Brush, shoe polishing, W. W. Worcester. 671,873
Buckle or clasp, ornamental, F. D. Thompson. 671,616
Button making machine, E. W. Silsby. 671,870
Can opener and knife and fork, combined tin, F. Wattne. 671,740
Cans, jars, etc., apparatus for seating and sealing covers on, E. K. Leffingwell. 671,930
Candy mold, H. Staub. 671,501
Cane sling tripping attachment, L. H. Avet. 671,874
Canister, soap, C. D. Kendall. 671,827
Car brake, automatic freight operating, W. H. Sauvage. 671,635
Car, convertible, R. K. & J. K. Ingram. 671,888
Car, convertible railway, J. A. Brill. 671,852
Car door, hopper bottom, G. I. King. 671,705
Carbonator, Collins & Griscom. 671,689
Card receptacle, R. A. Simonson. 671,454
Carriage, motor, W. J. Woosley. 671,575
Case. See Mandolin case.
Cash box, portable, J. B. Laumann. 671,486
Casket handle, E. R. Sargent. 671,710
Chair. See Swing chair.
Chair or stool base, T. H. Costello. 671,758
Chair seat, W. Weill. 671,742
Chimney top extension, P. H. Jacobus. 671,483
Chuck for mandrels of turning lathes, F. Mende. 671,629
Chuck wrench, E. T. Warn. 671,461
Cigarette machine, N. Du Brul. 671,917
Cigarettes, manufacture of mouthpiece, E. T. Gilliland. 671,859
Cistern cleaner, G. Latchem. 671,650
Clamp. See Cultivator tooth clamp.
Clamp and bench dog, J. F. Sipple. 671,733
Clothes tongs, L. W. Myers. 671,652
Clothes wringer, H. G. Anderson. 671,533
Clutch shipper, C. W. Levalley. 671,602
Cock, plug, H. J. Krebs. 671,678
Cock with removable valve, compression, E. G. Hedges. 671,481
Condenser, A. Snyder. 671,841
Conveyer for ropeways, A. S. Hallidie. 671,591
Corn husking machine, E. F. Obenchain. 671,653
Corn shellers, ear corn conveyer for, L. F. & J. E. Sherfey. 671,453
Corset clasp, L. C. Lacoste. 671,520
Cover, cooking utensil, M. C. Foresman. 671,795
Crates, etc., fastening for, Thomas & Gallion. 671,901
Cream separator, G. H. Smith. 671,640
Cuff holder, I. Freed. 671,545
Cultivator, B. Fisher. 671,475
Cultivator, J. I. Hoke. 671,728
Cultivator tooth clamp or fastening, J. Killefer. 671,677
Curtain hanging apparatus, T. J. Cloud. 671,469
Curtain pole, C. H. Campbell. 671,755
Curtains, combination fixture for lace and roller, J. Tamboer. 671,459
Cutter. See Band cutter.
Cyanids, making, J. Grossmann. 671,479
Dash foot, J. Q. Juvenile. 671,890
Decorating articles of manufacture, Kasebier & Vigelius. 671,519
Dentist's rubber dam, C. F. Horgan. 671,929
Dialkali cyanamid, making, J. Pfleger. 671,709
Diamond cross cutting machnie, E. Loesser. 671,830
Diamonds, working, E. Loesser. 671,831
Die press, E. W. Silsby. 671,871
Display rack, G. W. Barnett. 671,576
Door for trolley car barns, W. R. Kinnear. 671,445
Door opener, automatic sliding, D. Schuyler. 671,637
Door or window lifter, H. Heisler. 671,554
Door or window screen, S. J. Horcheler. 671,928
Door stop, E. P. Spence. 671,899
Draft equalizer, R. M. & H. M. Hickok. 671,919
Draft rigging, H. T. Krakau (reissue). 11,904
Draft rod slack adjuster, E. Lewis. 671,829
Drill coupling, J. A. Martin. 671,803
Driving mechanism, W. Scott. 671,495
Drying oven, H. F. J. Weijers. 671,741
Duplicating machine, P. H. Saunders. 671,634
Dye and making same, black trisazo, Elbel & Rosenberg. 671,543
Dye, azo, A. Tkatsch. 671,902
Dye, black sulfur, H. Gussmann. 671,908
Dye, brown azo, A. Tkatsch. 671,903, 671,904
Dye, violet, E. Schleicher. 671,896
Dyeing machine, J. Hussong. 671,799
Eccentric, W. A. Gladden. 671,476
Egg beater, S. B. Hegner. 671,516
Egg, nest, D. H. Cox, Jr. 671,471
Electric motor, H. P. White. 671,662
Electric motor controller, W. B. Potter. 671,490
Electric switch, F. Head. 671,883
Electric conductors, hydraulic press for splicing, T. J. McTighe. 671,835
Electrical distribution system, C. I. Young. 671,715
Elevator. See Hand elevator.
Elevator, Wolfman & Jensen. 671,506
Elevator door lock, A. M. Coyle. 671,878
Elevator wells, door operating device for, H. Bitner. 671,580
Embroidery ring, R. R. Essig. 671,474
Engine reversing and cut off mechanism, W. A. Milligan. 671,834
Engine reversing mechanism, Phillips & Hunt. 671,805
Engines, mixing and vaporizing device for explosive, C. O. White. 671,743
Engines, sparkling igniter for explosive, W. A. Bole. 671,718
Excavating machine, D. H. Snyder. 671,925
Exposure timer, L. K. Snell. 671,781
Fabric. See Woven fabric.
Fabric, J. H. Beamer. 671,812
Fan, S. G. Phillips. 671,527
Fan, electrically operated, R. W. Schmelz. 671,660
Faucet and bottle washer, combined, J. S. Hosley. 671,671
Feeding device for conveyers, etc., A. G. Johnson. 671,825
Fence, wire, Russell & Eakright. 671,612
Filter, A. Xander. 671,685
Filter and water cooler, household, A. Xander. 671,684
Filter, screen water, A. Xander. 671,683
Finger nail clipper, J. C. Ernst. 671,793
Firearm sight, J. J. Peard. 671,609
Fire extinguishing apparatus, Richards & Dunham. 671,775
Fire hose bridge, self locking, J. E. Ryan. 671,777
Fireproof blind, W. R. Kinnear. 671,444
Fireproof construction, A. L. A. Himmelwright. 671,596
Fireproof construction, W. Orr. 671,679
Fireproofing paper, composition for, I. Gordon. 671,548
Fishing bait, mechanical, Shakespeare & Locher. 671,613
Fishing tackle, S. H. Nesbit. 671,914
Flasks, apparatus for drawing patterns from, J. G. Johnston. 671,702
Float trap, variable pressure, W. C. Jennings. 671,442
Floor mat, E. J. Manning. 671,832
Fluids, apparatus for generating and utilizing elastic, W. L. Judson. 671,674
Fly trap, V. H. Crankshaw. 671,510
Fork. See Pitchfork.
Frequency or speed indicator, R. D. Mershon. 671,730
Fruit grader, R. G. Bailey. 671,646
Game board justifying device, E. T. Burrowes. 671,754
Game, parlor, R. Cummings. 671,855
Garment, D. Rabinowitz. 671,631
Gas burner, incandescent, C. S. Pinkham. 671,610
Gas engine or similar motor, C. C. & E. A. Riotte. 671,934
Gas generating apparatus, acetylene, E. N. Dickerson. 671,693
Gas generator, acetylene, P. N. L. Girardville. 671,796
Gas, making, L. Mond. 671,630
Gas producer, A. Laughlin. 671,892
Gases, apparatus for electrically treating, R. J. Yarnold. 671,507
Gate, J. G. Busch. 671,582
Gate, C. F. Stone. 671,641
Gear, changeable, W. G. Stolz. 671,456
Gear, compensating, H. P. Coleman. 671,719
Gear, differential, J. B. & A. Benson. 671,432
Gear, driving, Young & Danley. 671,785
Gear, driving, C. L. King. 671,828
Gear, reversing, F. J. Ball. 671,747
Gearing, change, K. G. Johnston. 671,826
Gearing, variable speed, F. J. Ball. 671,746
Gas bath tub, W. L. Harvey. 671,594
Glassware, mechanism for manufacturing, T. Coleman, Jr. 671,757
Glove, reversible, N. D. Newman et al. 671,562
Gloves, etc., fastener for, J. V. Washburne. 671,572
Governing device, gasoline engine, D. C. Wolfe. 671,714
Governor, E. J. Armstrong. 671,926
Grain drill disks, axial bearing for, C. B. Dempster. 671,539
Grain drill feed, Denyes & Schutt. 671,587
Grate, C. Yingling. 671,905
Grinding machine, A. H. Morton. 671,448
Gun cleaning tool, J. A. Rosenberg. 671,839
Gun, wire wound, W. Crozier. 671,879
Guns, means for preventing erosion of, A. Noble. 671,708
Hair curler, R. Reach. 671,838
Hammer, L. P. Gagnon. 671,821
Hand elevator, E. Sayre. 671,808
Handle. See Casket handle.
Handle bar extension, A. H. Field. 671,647
Harness attaching or detaching device, McCormick & Gordon. 671,706
Harvester belt tightener, C. Colahan. 671,470
Harvester reel, S. Nixon. 671,707
Hat fastener, L. Huppertz. 671,887
Heat, device for effecting the radiation of, H. A. Knox. 671,768
Heating burner, L. J. Wing. 671,574
Heating furnace, continuous, A. Laughlin. 671,893

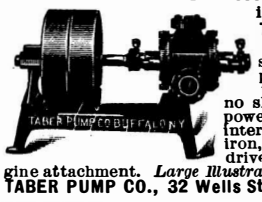
(Continued on page 253)


"Star" Foot and Power Screw Cutting Automatic Cross Feed Lathes
FOR FINE, ACCURATE WORK
Send for Catalogue B.
SENECA FALLS MFG. CO.
695 Water Street,
Seneca Falls, N.Y., U.S.A.

ENGINE & FOOT LATHES. MACHINE SHOP OUTFITS. TOOLS AND SUPPLIES. SEBASTIAN LATHE CO. 120 CULVER ST. CINCINNATI, O.

Queen Transits and Levels
High Grade Instruments with the Latest Improvements.
160 page Engineering Catalogue on application.
THE QUEEN
240 page Mathematical Catalogue on application.
ENGINEERS' AND DRAFTSMEN'S SUPPLIES.
QUEEN & CO., Optical and Scientific Instrument Works,
59 Fifth Ave., New York. 1010 Chestnut St., Phila.

There is never any question about the quality of a
B. F. BARNES UPRIGHT DRILL.
The tool here illustrated is our 20-inch Drill, and we guarantee it to drill up to 1 inch in steel and 1¼ inch in cast iron at a good gait and without strain. We build larger sizes and will be glad to send full data on our entire line to interested people.
B. F. BARNES CO., Rockford, Ill.

PERFECT - PUMP - POWER.

is attained only in the TABER ROTARY PUMPS
They are mechanical, simple and durable. Will pump hot or cold fluid, thin or thick. Requires no skilled mechanic. Most power at least cost. All parts interchangeable. Made of iron, steel or bronze. Can be driven by belt, motor or engine attachment. *Large Illustrated Catalogue free.*
TABER PUMP CO., 32 Wells St., Buffalo, N.Y., U.S.A.

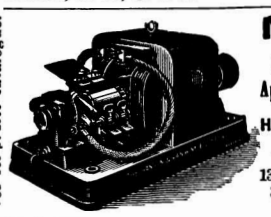
Gold Stocks Free!
Just to introduce our big western weekly mining paper (7th year) we will send a block of 5 shares *full paid* and non-assessable in a **Cripple Creek Gold Mine** *Free.* You must send us 50c. cash or stamps for a 6 months' trial sub. to our illustrated weekly paper. Clubs of 5 or more 40c. each. Full mining news. Certificates sent by return mail issued *to you.* Cripple Creek is a world-beater. Address ROCKY MOUNTAIN MINER (Inc.), Denver, Colo.

IMPROVED GASOLINE BURNER

Gas is admitted through circular slots instead of perforations. It is fitted with pilot light. Can be left burning any length of time. Carriage is always ready to start. This burner is a quick steamer, gives a blue flame, and will not light or blow back. Is fitted with automatic fire regulator which shuts gas off from main burner at any desired pressure. FRANK MILNE, Everett, Mass.

FOR VEHICLE AND MARINE PURPOSES.

Nothing better or more economical than our four-cylinder motors. Possess every known point of excellence. Durable in every part. Detachable igniters, heavy bearings and shifting spark, water-jacketed head, runs any speed from 100 to 1500 per minute. 4½ to 10 H.P. Fully guaranteed. Ground joints throughout.
Buffalo Gasoline Motor Co., Buffalo, N.Y., U.S.A.
Apply for Catalogue.

Send your business card for 160 p. 1900 catalogue.

NICKEL AND Electro-Plating Apparatus and Material.
THE Hanson & VanWinkle Co., Newark, N.J.
136 Liberty St., N.Y.
30 & 32 S. Canal St Chicago.

GASOLINE MOTOR CASTINGS
For MARINE, VEHICLE and BICYCLE MOTORS,
with Working Drawings.
LOWELL MODEL CO., 22 Wiggin St., Lowell, Mass.

It triumphs over obstacles; it enables you to gratify your highest ambitions; to achieve; to accomplish; to win. It marks the difference between success and failure and makes man the supreme master of his destiny. By our new system you can learn this wonderful science in a few days at your own home, you can cure diseases, bad habits and wield wonderful power and influence over others. Our richly illustrated book on Hypnotism, Personal Magnetism, Magnetic Healing, etc., tells how. It's free. It is intensely interesting and full of startling surprises. It has been the means of starting thousands of persons on the road to success. A postal card dropped in the box at the corner will bring this wonderful book to your very door. Address,
New York Institute of Science, Dept. P. T. 14, Rochester, N.Y.

© 1901 SCIENTIFIC AMERICAN, INC.

CREST MFG. CO.
CAMBRIDGEPORT, MASS.
3 to 5 H. P. MOTORS

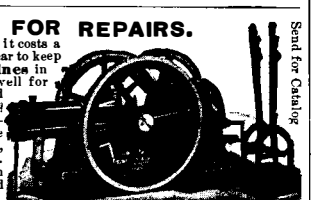
CREST Sparking Plug
Coils Batteries Carburetors

HOO-HOO BABBITT METAL
Is the very best for high speed journals and heavy bearings. Made only by
MORE-JONES BRASS & METAL CO.,
ST. LOUIS, MO.

THE AUTO-CARBURETTOR
made upon a new principle furnishes a reliable explosive mixture. Easy ignition and greatest expansion. No pump required. Uses any grade of gasoline with no waste. Especially adapted to automobile and cycle motors. Our customers say it is the best Carburettor in the market. We make also the **Register Valve** for controlling the flow of gasoline or other fluids. Write us for prices and booklet on Carburettors.
Gasoline and Steam Engines and Automobiles built to order and repaired.
The Avery & Jenness Co.,30 W.Washington St.,Chicago

KEEP POSTED ON AUTOMOBILES
THE HUB will post you. THE HUB is the leading carriage and automobile, journal, and gives authentic information on automobiles, AUTOMOBILES Don't buy an automobile until you have read and studied THE HUB. At News-stands or by mail, 25 cents. Six months' subscription, $1.00. TRADE NEWS PUBLISHING CO., Room 6, 24 Murray Street, NEW YORK.

ANY BICYCLE RIDER may and ALL REPAIRERS do need our 1901 A. & J. Hanger.
If you have a used-up hanger to replace; if you have frames with odd-sized brackets; if you want a higher gear; Write us and find out all about the A. & J. Hanger. We send the complete set all ready to go into your frame. No bother brazing or re-enameling. We can fit any frame. THE AVERY & JENNESS CO., 30 W. Washington St., Chicago, Ill.

$1 YEARLY FOR REPAIRS.
It has been found that it costs a trifle less than $1 per year to keep our **Hoisting Engines** in repair. That speaks well for their superior make and durability, doesn't it? There is no more economical or serviceable engine made for mines, quarries, docks, etc. Much cheaper than steam. Both friction and geared hoist 6 to 150 h. p.

Send for Catalog
Weber Gas & Gasoline Engine Co., P. O. Box 1114-a, Kansas City, Mo.

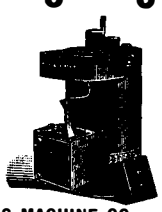
If Your Eye Could See

the filth that passes through ordinary water faucets you would be alarmed and disgusted. These germs are the cause of most diseases. Pure water would prevent them and perfectly pure water can be produced only by using the widely celebrated
Berkefeld Filter,
which is constructed on the most scientific and hygienic principle. Easy to clean and care for. Rapid filtration. One gallon of pure water in 4 minutes.
Berkefeld Filter Co., 2 Cedar St., New York.

Acetylene Gas Burners.
Schwarz Perfection Lava Burner.
Highest awards in all Acetylene Expositions. Made of one piece of *lava*. Are faultless and *every one tested and guaranteed.* ☞ *Send for Price List.*

NO Blowing. Smoking. Carbonization. Perfect Alignment.
Sole Agents for the U. S. and Canada.
M. KIRCHBERGER & CO.
50 Warren Street, New York.

AGENTS TO RIDE ECLIPSE CYCLES
We want a gentleman and lady rider on an Eclipse Cycle in every town in the U. S. to introduce them. BIG MONEY for you if you can do it. Write for proposition.
SEYMOUR MFG. CO., 99 Chambers St., N. Y. Dept. 5.

Acetylene Gas Lighting
Reduced to the most Efficient, Safest, Simple and Economical Use.
We guarantee our machines perfectly automatic in action, to extract all the gas from the carbide, and absolutely no over production or loss of gas. Approved by the various Boards of Fire Underwriters. Standard sizes 10 to 150 lights. Exclusive territory given to responsible agents. Correspond with

NIAGARA FALLS ACETYLENE GAS MACHINE CO.,
Niagara Falls, N. Y. and Canada.

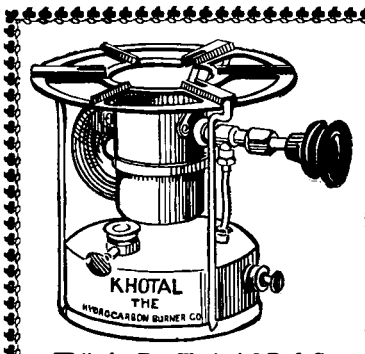
GERE GASOLINE ENGINES
SIMPLEST BOAT ENGINES MADE
CABIN AND OPEN BOATS
ENGINE CASTINGS, BOAT FRAMES
GEO. M. GERE YACHT AND LAUNCH WKS.
GRAND RAPIDS, MICHIGAN.
NEW CAT FOR 4 STAMPS

"HOT BATH IN ONE MINUTE" FOR ONE CENT.

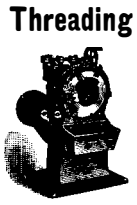
Moses, by the aid of a rod, struck a rock and got cold water. You by the aid of a
Humphrey Crescent Heater
strike a match and get hot water. They require no complicated piping, simply connect with water and gas in your bathroom. **Guaranteed.**
☞ *Write for Booklet.*
HUMPHREY MFG. & PLATING CO., Kalamazoo, Mich.

Hinge, blind, J. G. J. Davis	671,819
Hinge, door, F. M. Champion	671,434
Hitching horses, vehicle device for, I. N. Lachner	671,601
Hoisting and conveying apparatus, W. S. Halsey	671,797
Holder, W. H. Ford	671,437
Hook and eye card, A. E. Waggoner	671,503
hooks and eyes, japanning, A. E. Waggoner	671,504
Horse detaching device, H. L. Gray	671,822
Horse holding attachment for vehicles, Clark & Barker	671,688
Horse holding device, R. Winchel	671,850
Horseshoe, nailless, M. Boulgar	671,433
Horseshoeing rack, J. Z. Benedict	671,750
Horses or other animals, apparatus for removing, A. C. W. Hobman	671,668
Hot air engine, O. P. Ostergren	671,526
Husking pin, J. P. Flaugher	671,941
Hydraulic impact engine, C. N. Dutton, 671,541,	671,542
Ice cream mold and dipper, M. Bach	671,788
Incubator radiator, E. J. Hicks	671,886
Indicator and seal lock combined, W. Scharnweber	671,636
Inscription plate for burial cases, J. J. De Lacy	671,511
Insect trap, J. C. Nielsen	671,449
Insulator, self locking, W. P. Beardsley	671,876
Ironing table, S. H. Witt	671,644
Ironing table, C. A. Perry	671,657
Journal bearing, L. P. Delano	670,586
Junction box, E. T. Greenfield, 671,762,	671,763
Kite, W. E. Mowrer	671,865
Knitting machines, let off and controlling means for, F. Wilcomb	671,848
Knives, forks, etc., with handles of same, connecting fangs of, P. Erhardt	671,544
Knob attachment, C. E. Smith	671,943
Lacing, shoe, A. A. Soderberg	671,712
Lamp burner, oil, F. T. Williams	671,464
Lamp, electric arc, T. E. Drohan	671,512
Lamp heater, electric glower, F. M. Goddard	671,725
Lamp receptacle, electric, W. E. McDonald	671,603
Lamp shade, H. A. Catlin	671,814
Lamps, flexible and adjustable supporting device for electric, W. F. Brewster	671,618
Lamps, flexible supporting structure for electric, W. F. Brewster	671,619
Lampblack, making, L. J. E. Hubou	671,672
Lathe, E. A. Schumacher	671,565
Lathe, W. Robinson	671,806
Lathe bed, R. & W. B. Lang	671,521
Lathes, planers, etc., variable speed and reversing mechanism for, R. B. Marshke	671,487
Lawn sprinkler, A. Johnston	671,485
Lawn trimmer, A. Lawrence	671,802
Leather, artificial, J. P. Nealon	671,604
Leaves from their stems, apparatus for separating lateral portions of, L. P. Whitaker	671,846
Leaves from their stems, separating flexible portions of, L. P. Whitaker	671,845
Lifting jack, Ballard & Nickerson	671,748
Lime, treating, H. P. Dodge	671,621
Liquid filling receptacle, J. Devantery	671,857
Liquid meter, Ashley & Martin	671,913
Lock, C. E. Smith	671,942
Lock bolt, E. F. Comber	671,792
Locomotive draft rigging, J. Elder	671,939
Log carrier, P. Rooney	671,659
Loom, W. F. Draper	671,667
Loom, narrow ware, E. Haast	671,624
Loom shuttle, E. H. Ryon	671,633
Loom shuttle, S. A. Dudley	671,720
Loom shuttle, W. Fischer, Jr	671,820
Loom shuttle easing device, H. Rycroft	671,807
Loom warp rest, E. E. Barlett	671,534
Loom warp stop motion, W. F. Draper	671,540
Loom warp stop motion, C. H. Draper	671,666
Mail box, M. J. Daly	671,692
Mailing tube, H. L. Gray	671,823
Mandolin case, A. Shaeffer	671,567
Manuscripts, etc., holder for, J. Jerabek	671,484
Match box, W. A. Patten	671,656
Measure, tape, S. E. Creasey	671,690
Measuring instrument, distance and altitude, L. N. Hornbeck	671,824
Meat press, W. S. Swift	671,529
Mechanical movement, J. L. & J. E. Lee	671,729
Mercerized apparatus, E. J. Nelson	671,867
Metal, rolls for cutting expanded, L. E. Curtis	671,915
Mining machine, C. E. Davis	671,818
Mop wringer, T. F. Condon	671,815
Mordanting, V. Lendecke	671,894
Mordanting cotton, Marot & Bonnet	671,560
Mosquito canopy, W. Woodward	671,912
Motor, H. T. Vaders	671,739
Motor brake, spring, B. G. Royal	671,528
Motor controller, F. B. Duncan	671,907
Music sheets for self playing instruments, machine for perforating, R. A. Gally	671,724
Muzzle, F. Eiffert	671,472
Napping machine, J. H. Stone	671,457
Nut lock, Comminge & Sipe	671,584
Nuts, automatic machine for tapping, Gros & Brown	671,590
Ordnance, shoulder pointed, A. Normand	671,836
Ore separator, F. H. A. Wielolaski	671,573
Organ, automatically operated, J. W. Crooks	671,691
Organs, attachment for reed or pipe, E. R. Bailey	671,875
Packing, metallic rod, T. G. Saxton	671,681
Packing, piston, W. S. Halsey	671,551
Packing ring, W. H. Hammon	671,697
Paper box, J. T. Craw	671,759
Paper making machines, screen plate for, R. Smith	671,780
Parer, potato, J. Monk	671,525
Paste jar, J. B. Davids	671,927
Paste, etc., receptacle for, C. Crane	671,509
Pen, fountain, C. E. Fowler	671,881
Penholder, M. Sporleder	671,809
Pencil pocket holder, W. C. Tillinghast	671,738
Pharmaceutical compound and making same, A. Eichengrun	671,622
Phonograph, F. D. Goold	671,513
Phonograph, E. A. Hawthorne	671,625
Photographic or other prints, apparatus for washing, H. B. Brockett, Jr	671,466
Photographic printing surface and making same, Fulton & Gillard	671,882
Pinao action, H. C. Schwarz	671,566
Pill, etc., coated, F. H. Metcalf	671,804
Pin. See Safety pin.	
Pipe coupling, W. H. Hammon, 671,695,	671,696
Pipe trap, C. R. Grinsted	671,514
Pipe wrench, A. W. Warnock	671,571
Pitchfork, A. B. Clay	671,850
Plaiting machine, D. L. Chandler, 671,790,	671,791
Planter, corn, A. C. Peterson	671,922
Planters, rocking axle for corn, L. E. Waterman	671,462
Plow, Morelock & Poff	671,864
Plow handle, C. A. Hobbs	671,626
Pneumatic power cylinder, N. O. Lindstrom	671,559
Polish rod grip, W. J. Beighey	671,749
Polyphone attachment, N. Jensen	671,800
Poultry suspending device, H. B. Stanert	671,900
Powder box and duster, J. H. Johnson	671,766
Power generating apparatus, J. Fisher	671,723
Power transmitting device, W. L. Judson, 671,675,	671,676
Power transmitting mechanism, F. T. Overrocker	671,655
Printing, E. Hett (reissue)	11,902
Printing machine, F. X. Hooper	671,861
Printing plate holder, C. S. Mills	671,932
Printing press form lifter, W. Scott	671,496
Printing surfaces, machine for making, E. Hett (reissue)	11,903
Projectile, W. F. Cole	671,877
Pulp molding machine, E. Hubbard	671,517
Pump driving device, C. H. Clayton	671,468
Punching and forging apparatus, J. H. Baker	671,430
Punching and forging machine, J. H. Baker	671,431
Punka motor, hydraulic, H. Spuhl	671,455
Rack and pinion, J. W. Carmack	671,583
Rail clamping device for thin or sheet metal railway ties, C. Oldroyd	671,607
Rail fastener, J. M. Spaulding	671,734
Rail joint, Nichols & Boughton	671,605
Rail joint, N. L. Dallard	671,916
Railway contact shoe, electric, Hanchett & Murphy	671,515

(Continued on page 254)



Write for Free Illustrated Book G.
The "Khotal"
Blue Flame Oil Stove
(FOR HOME OR CAMP OR YACHT)
generates gas from common kerosene. It will boil a quart of water in two minutes and cook a dinner quickly. It can be regulated to any desired degree of heat. It has no wick and no asbestos substitute. It is strong, durable and ornamental, being made of brass of superior finish and excellent workmanship. A child can operate it.
The "Khotal" costs little to buy and little to run. The combustion is perfect; no smoke, no smell, no soot deposit on pots and pans.
Picture shows smallest size, 8 ins. high, weight 5½ lbs. Price $3.75. Made in sizes large enough to cook a course dinner.
THE HYDROCARBON BURNER CO., 197 Fulton St., New York
Boston, Mass.: Globe Gas Light Co., 77-79 Union St.

The Perfection of Pipe Threading
is admitted to be reached when our
No. 9½ PIPE THREADING MACHINE
is used. As a hand machine it is the only one known that will cut and thread an 8 inch pipe with ease and satisfaction. One valuable feature is, that it has no arbitrary lead screw for determining style or pitch of thread to be cut. ☞ *Send for Catalogue.*

THE MERRELL MFG. CO.
501 Curtiss St., Toledo, Ohio.

"NEW GEM" SAFETY RAZOR

IMPOSSIBLE TO CUT THE FACE.
IT'S THE BEST AND SIMPLEST SAFETY EVER DEVISED. NO EXPERIENCE REQUIRED.
WE GUARANTEE AND KEEP THEM SHARP FOR ONE YEAR.
PRICE $2.00 POSTPAID.
SEND FOR ILLUSTRATED PRICE LIST.
THE GEM CUTLERY CO.
37 READE ST. NEW YORK.

Savings Banks 3% vs. Industry 12%
IF YOU Have some money in a savings bank or have investments that are paying you but three or four per cent., WRITE TO US and we will show you our plan for the investment of your money where it will probably net you 12 per cent. per annum.

The United States Steel Company
Has been established for two years, and we have one plant which alone cost us $250,000, but it is too small to fill the orders for JUPITER STEEL CASTINGS.
The capital stock of The United States Steel Company is three million dollars, divided into six hundred thousand shares, with a par value of $5.00 each. Every share is full paid and non-assessable. Three hundred and forty thousand shares of this stock have been issued, and for eighteen months a dividend of 12 per cent. per annum has been paid on the outstanding stock.
The United States Steel Company has the sole right to manufacture JUPITER STEEL CASTINGS, which are castings of the quality of forgings, and the NEAL DUPLEX BRAKE, which is now in use on the system of the Boston Elevated Railroad and other roads. See description, April 6, of this paper.
To provide further capital for the enlargement of their plant, so that they can supply the demand for Jupiter Steel Castings and to build the Neal Duplex Brakes, the Board of Directors have authorized the sale of ten thousand shares of the treasury stock at par ($5.00) per share.
We will be pleased to send to those who are interested in an investment a full prospectus of this company, together with a record of what has been accomplished in the past two years.
THE UNITED STATES STEEL COMPANY
143 OLIVER STREET, BOSTON, MASS.

THIS GRINDER
Has no pumps, no valves. No piping required to supply it with water. Always ready for use. Simplest in construction, most efficient in operation.
☞ *Send for Catalogue.*
UPRIGHT DRILLS
Complete line, ranging from Light Friction Disk Drill to 42" Back Geared Self-Feed. Latest improvements. Up-to-date in every respect.

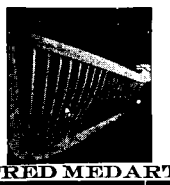
W. F. & JOHN BARNES CO., Established 1872. 1999 RUBY ST., ROCKFORD, ILL.

50 YEARS' EXPERIENCE
PATENTS
TRADE MARKS DESIGNS COPYRIGHTS &C.
Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.
Patents taken through Munn & Co. receive *special notice*, without charge, in the
Scientific American.
A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.
MUNN & Co. 361 Broadway, New York
Branch Office, 625 F St., Washington, D. C.

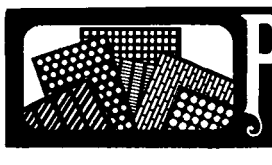
REVERSING STEAM TURBINE.—PARSON'S recently perfected turbine for boats. Illustrations showing details. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1158. Price 10 cents, by mail, from this office, and from all newsdealers.

HOLD ON THERE!

Send 3c. for catalog of
Monarch Marine Gasoline Engines.
¾ to 45 H. P. $200 up.
Grand Rapids Gas Engine & Yacht Co., Grand Rapids, Mich.

PROSPECTIVE BOAT BUYERS.

By constructing your boat from a set of my **Boat Building Materials** more than one-half the boat factory's price can be realized. Also economize freight 500 per cent. Launches, Sail and Row Boats, Gasoline Engines. *Catalog free.*
FRED MEDART, 3545 DeKalb St., St. Louis, Mo.

SAVE MONEY BY USING THE
COMMERCIAL MUTOSCOPE.
Takes the place of expensive demonstrations. A moving picture showing your device in action. In a small, compact traveling case. Infinitely superior to models. Send for illustrated pamphlet and prices.
AMERICAN MUTOSCOPE & BIOGRAPH CO., 841 Broadway, New York.

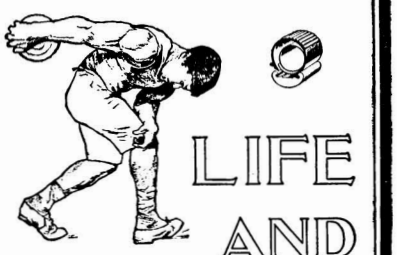

PERFORATED METAL
OF EVERY DESCRIPTION AND FOR ALL USES.
THE HARRINGTON & KING PERFORATING Co. 225 N. UNION ST., CHICAGO, ILL. U.S.A.

© 1901 SCIENTIFIC AMERICAN, INC.

GRAND PRIZE, PARIS, 1900.
HIGHEST AWARD POSSIBLE.

NO
DIRTY HANDS
WITH THE SMITH PREMIER TYPE CLEANING DEVICE
IT ELIMINATES THAT OBJECTIONABLE FEATURE SO COMMON TO OTHER TYPEWRITERS AND KEEPS BOTH THE OPERATOR AND THE TYPE FREE FROM DIRT
THE SMITH PREMIER TYPEWRITER CO., SYRACUSE N.Y. U.S.A.
AN IMPROVEMENT AFFIXED ONLY TO SMITH PREMIER TYPEWRITERS
SEND FOR CATALOGUE

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Details of furnaces for making the carbide, gas generators, gasometers, burners, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035, 1038, 1057, 1064, 1071, 1072, 1082, 1083, 1084, 1085, 1086, 1104, 1124, 1132, 1149** and **1150**. Price 10 cents each, by mail, from this office, and all newsdealers.



LIFE AND STRENGTH

VITALITY is as essential to a bicycle tire as to the human frame—the entire value of a wheel depends upon it. G & J TIRES live longer, ride easier, are safer and more easily mended than any other tire made. G & J TIRE CO., Indianapolis, Ind.

SECTORLESS WIMSHURST MACHINE.—This article gives directions for making. 4 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT **1131**. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for new catalogue.

SATISFACTION GUARANTEED.

Acetylene Gas Generation PERFECTED.

COLT TRADE MARK

The apparatus embodies entirely new principles. Safe, automatic, simple to install and operate. Next to daylight in cost and quality. Any capacity from table lamps to town plants. Also high grade "Criterion" stereopticons.

J. B. COLT CO.,
Dept. S, 21 Barclay St., New York.
Boston. Chicago. Philadelphia.

Building Edition Scientific American

MONTHLY, $2.50 PER ANNUM.
SINGLE NUMBERS, 25 CENTS.

The BUILDING EDITION for 1901 is the handsomest magazine in the United States. It has many new and important features. Send 25 cents for the March number, and see the new departments. The illustrations and cover are more attractive than ever. Send for "Are You About to Build?" and be convinced.

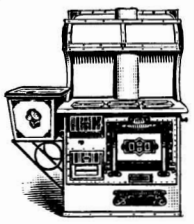
NEW DEPARTMENTS.

Monthly Comment.
Interviews with Architects.
New Books.
New Building Patents.
Notes and Queries.
Digest of Current Articles.

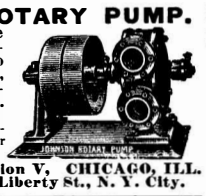
MUNN & CO.,
Publishers, 361 Broadway, New York.

Railway fog signaling apparatus, G. Jefferies	671,556
Railway system, electric, P. E. Herkner	671,482
Railway system, J. M. Murphy	671,866
Railway tie, C. Oldroyd	671,606
Refrigerator, subterranean, W. H. & W. H. Reynolds, Jr	671,564
Refrigerator tank, J. Hamilton	671,798
Register, C. R. Harper	671,593
Reversing mechanism, C. C. & E. A. Riotte	671,935
Rolling mill, S. V. Huber	671,439
Rolling tapering metal for saws, etc., apparatus for, C. Prouty	671,450
Rotary engine, L. E. Krotz	671,557
Rotary engine, G. Schleicher	671,936
Rotary engine, J. W. Sunderland	671,944
Sad iron, electrically heated, J. D. Theisz	671,569
Saddle fork, M. R. Hunter	671,765
Safety pin, E. Snedeker	671,615
Sand blasting device, H. B. Prosser	671,774
Sand screening machine, E. E. Hanna	671,764
Sash lock, A. J. McGehee	671,921
Saw attachment, hand, E. A. Michalscheck	671,488
Saw, metal, Miller & Gard	671,910
Saws, manufacturing, C. Prouty	671,451
Scale base, swivel, W. F. Stimpson	671,736
Screw machine, G. Sittmann	671,568
Screws for buffing, machine for chucking, M. A. Montambault	671,731
Seams of metal cans, etc., machine for fusing side, Gersant & Bullifant	671,546
Seams of metal cans, etc., machine for fusing top and bottom, Gersant & Buttifant	671,547
Seed drill with fertilizer attachment, R. A. Gray	671,726
Sewing and binding machines, signature packer for book, W. G. Trevette	671,531
Sewing machine, book, W. G. Trevette	671,530
Sewing machine needle setting device, A. Hillmann	671,699
Sewing machine, ornamental stitch, W. N. Parkes	671,680
Shaft hanger, H. T. Hallowell	671,550
Shaft, vehicle, J. B. Haug	671,553
Shearing device, H. L. Gulline et al	671,480
Sheet delivery apparatus, R. A. Bartlau	671,508
Sheet delivery mechanism, W. Scott	671,493, 671,494
Sheet metal cans, manufacture of, E. Small	671,639
Sheet metal cups, making, A. G. Anderson	671,427
Sheet metal pickling machine, O. Gauhe	671,588
Shingle sawing machine, E. E. Poag	671,611
Shirt waist attachment, J. C. Kimsey	671,920
Shirt waists, etc., holder for, F. E. Buddington	671,664
Shoe fastening, A. A. Soderberg	671,711
Shutter, window, F. Chase	671,756
Shuttle, E. H. Ryon	671,632
Silver or silver and gold, treating ores containing, E. D. Kendall	671,704
Snow plow, railway, W. C. Goss	671,623
Soldering iron, G. Van Camp	671,460
Space in crowded municipalities, means for utilizing, H. Bergeron	671,686
Speed changing mechanism, P. Winsor	671,505
Speed mechanism, variable, E. Marx	671,561
Speed mechanism, variable, A. G. S. Lyford	671,895
Speed regulator, W. J. Barnes	671,465
Spindle. See Spinning spindle.	
Spinning spindle, Goldsmith & Hamblin	671,694
Spoke driving machine, F. Unckrich	671,842
Spool, E. N. Lorscheider	671,446
Stamp, hand, J. C. Johnson	671,648
Steam boiler, W. E. Dickey	671,665
Steam boiler, E. T. Birdsall	671,937, 671,938
Steam engine, W. W. Lewis	671,628
Steam engine, J. C. Speirs	671,783
Steam from vehicle motors, means for disposing of exhaust, Milne & Killam	671,933
Steam generator, Thompson & Barnes	671,713
Sterilizing apparatus, A. V. M. Sprague	671,499
Sterilizing apparatus door, A. V. M. Sprague	671,500
Still, ammonia, S. Thurstensen	671,810, 671,811
Stoker, mechanical, A. Hofmann	671,555
Stool and cane, E. Slagle	671,638
Stove, oil, W. H. Wilder (reissue)	11,905
Stuffing box, rocking or oscillating, G. Tessier	671,643
Swing chair, L. S. Copper	671,620
Syringe, vaginal, J. Graham	671,477
Tanning liquids, purifying, Thompson & Blin	671,570
Tap driving head, Morgan & Williams	671,447
Telegraph system, wireless, H. Shoemaker	671,732
Telephone desk, C. E. Bartholomew	671,577
Telephone receiver, electric, Strauss & Stein	671,458
Telephone receiver holder, T. Emerson	671,473
Thermometric alarm system, N. Smith	671,898
Threshing machine self feeding mechanism, C. H. Bidwell	671,579
Tire and wheel rim therefor, pneumatic, R. Bryan-Haymes	671,535
Tire fastener, W. Jennings	671,700, 671,701
Tire setter, Adjustable rubber, J. A. Johnson	671,889
Tire upsetting machine, R. Bates	671,716
Tire, vehicle, J. Coomber	671,585
Tire, vehicle elastic, F. E. Hall	671,549
Tires to wheels, means for securing elastic, W. F. Williams	671,849
Tobacco pipe, L. B. Heep	671,909
Toilet article, A. C. Preece	671,837
Toilet preparations, receptacle for, C. B. Tuttle	671,682
Tongue support, vehicle, B. F. Hennessey	671,698
Toy, N. M. Snyder	671,498
Toy, electric, A. A. Kent	671,891
Track sanding apparatus, locomotive, G. W. Mudd	671,651
Train control system, W. B. Potter	671,491
Tripod, camera holding, B. A. Slocum	671,661
Trolley finder for electrical railways, P. Goldsmith	671,438
Truck, car, C. T. Westlake	671,844
Truck, elevating, A. A. Scott	671,452
Truck for autocarettes, J. W. Darley, Jr	671,856
Tubes, manufacture of metallic, H. Perrins	671,563
Tubes or tubular objects, manufacture of, E. F. Boulet	671,752
Turbine, A. Hendry	671,885
Typewriter, A. H. Bedworth	671,578
Typewriter, H. L. Arnold	671,663
Typewriting machine, W. S. Perry	671,773
Umbrella, folding, M. M. Appleman	671,645
Umbrella notch and rib joint, J. J. Whittlesey	671,463
Unloading device for goods, trucks, wagons, etc., F. W. Koffler	671,599
Valve, N. C. Locke	671,770
Valve, C. W. A. Koelkebeck	671,862
Valve, gate, R. Shirley	671,614
Valve gear, explosive engine, R. Longtine	671,931
Valve grab, A. A. Yackee	671,617
Valve operating mechanism, W. H. Sauvage	671,911
Valve, reducing, W. C. Jennings	671,441
Valve, rotary gate, W. C. Jennings	671,443
Valve, safety, A. Lohbiller	671,523
Valve, self cleaning float, A. B. Crowder	671,854
Valve, self closing, G. A. Blake	671,717
Vapor burner, incandescent, Heinritz & McCuen	671,884
Vehicle driving mechanism, J. Grimme	671,478
Vehicle tool carrier, G. A. Macker	671,771
Vehicles, brace for motors of self propelled, J. H. Bullard	671,687
Veneer, manufacture of built up, P. S. Brown	671,467
Venilating reflector, adjustable, W. Amos	671,851
Viscosimeter, J. R. Reilly	671,658
Wagon, S. L. Mitchell	671,863
Wagon, dumping, E. P. Le Gore	671,627
Washboard, P. J. Joecken	671,801
Washing machine, J. L. Davis	671,436
Washing machine, reversible, E. J. Kelly	671,703
Water gage glass, J. Devantery	671,858
Water, means for raising, J. Kurtz	671,600
Water purifying and filtering apparatus, electrolytic, C. E. Holland	671,946
Water purifying apparatus, H. Reisert	671,492
Water raising apparatus, J. E. Bacon	671,428
Water tube boiler, downdraft, O. D. Orvis	671,772
Wave motor, A. R. Hamilton et al	671,592
Wave power, apparatus for the utilization of, B. M. Fletcher	671,794
Weather strip, A. W. Allison	671,786
Well digging apparatus, band wheel for, C. L. Bloom	671,751
Wells, making or improving, J. E. Bacon	671,429
Wheat, cleaning, S. D. Hoole	671,670
Wheat cleaning machine, S. D. Hoole	671,669

(Continued on page 255)



WILL SHIP C. O. D. FOR $25.00
WITH PRIVILEGE OF EXAMINATION.
FREIGHT PREPAID TO YOUR STATION.
"THE WILLARD STEEL RANGE"
Has 6 8-in. lids, oven 17x21x12, 15-gallon reservoir and warming closet, lined throughout with asbestos, burns wood or coal. This special inducement is offered for a limited time only. Mention this paper.
WM. G. WILLARD, Manufacturer, 619 and 621 N. 4th St., St. Louis, Mo.

THE JOHNSON ROTARY PUMP.
Simple of construction, positive in action, easy and quiet in operation. Especially adapted to pumping soap, oil, sugar, lard, glucose, acids, starch, glue, varnish, corn and water, malt, etc. Large sizes for irrigation.
Made as a belt or steam pump, or combination, or operated by electric motor or gasoline engine. Manufactured by

DAVIS-JOHNSON CO., Station V, CHICAGO, ILL.
James H. Robley, Agent. 95 Liberty St., N. Y. City.

DICKERMAN'S DURABLE DESKS
Don't buy until you get our catalogue—100 pages of money saving values.
AMERICAN STORE STOOL CO., 33 Howard St., New York

THE NEW BRISTOL COUNTER

Registers an accurate account of work done on printing presses, grain tallies, weighing, measuring and other automatic machines. Counts up to 1,000,000 and repeats automatically. Simple, accurate, durable. Special counters to order. *Send for circular.*
C. J. ROOT, Bristol, Conn., U. S. A.

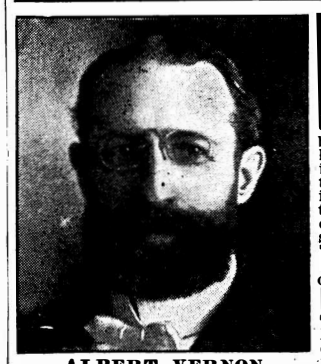
BICYCLES BELOW COST
5000 High Grade guaranteed 1901 Models $10 to $18 with best equipments,
'99 & '00 MODELS, $7 to $12
Good Second Hand Wheels, best makes in perfect riding order. $3 to $8 *Must be closed out.*
We ship anywhere on 10 days trial without a cent in advance.
EARN A BICYCLE distributing catalogs for us. You can make money as our agent.
Write at once for our Bargain List and Special Offer.
MEAD CYCLE CO. Dept. 62 L Chicago.

$25.50 BUYS A BUGGY
(with top $33.) We manufacture a full line of Buggies, Carriages and Harness all of latest styles. Superior quality. Prices defy competition. The entire product of 2 enormous factories. Sold direct to consumer only. SAVE DEALER'S PROFIT. Every Carriage guaranteed. Sent on approval. Your money back if not satisfied. Write for Special Offer.
UNION BUGGY COMPANY, 218 Saginaw St., PONTIAC, MICH.

THE ELECTRIC HEATER.—A valuable paper, with working drawings of various forms of the electrical heaters, including electric soldering iron, electric pad for the sick, etc. 6 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT **1112**. Price 10 cents. For sale by Munn & Co. and all newsdealers.

I Teach by Mail with Perfect Success My Original and Scientific Method of PHYSIOLOGICAL EXERCISE

without any apparatus whatever, and requiring but a few minutes' time in your own room just before retiring. By this condensed system more exercise can be obtained in ten minutes than by any other in two hours, and it is the only one which does not overtax the heart
It is the only natural, easy and speedy method for obtaining perfect health, physical development and elasticity of mind and body.
If you will follow my instructions for a few weeks, I will promise you such a superb muscular development and such a degree of vigorous health as to forever convince you that intelligent direction of muscular effort is just as essential to success in life as intelligent mental effort.
Pupils are of both sexes ranging in age from fifteen to eighty-six, and all recommend the system. Since no two people are in the same physical condition, individual instructions are given in each case.
Write at once, mentioning SCIENTIFIC AMERICAN, for full information and endorsements from many of America's leading citizens.
ALOIS P. SWOBODA, 57 Washington St., Chicago


ALBERT VERNON.
PSYCHRATISM The new discovery by Prof. Albert Vernon, now given to the world for the first time.
You want it. You are not competent to combat the influences of the world without it. With a knowledge of the principles of this grand science failure has been changed to success; the sick have been made well. It is a marvelous force available in the every day affairs of life between man and man in business, NOT HYPNOTISM It is not in sickness and health. Psychratism is simply the power of putting another to sleep nor a name to mystify. Psychratism is a science and appeals to man's intellect and reason. It enlightens; makes truth of mystery and is the X-Ray of Self-Development and personal influence, enabling one to see and understand all that has been attributed to supernatural agency, hypnotism and occult influences during the past ages.
THE VERNON SANATORIUM is the institute where the sick are cured by Psychratism without drugs of any kind. All diseases and habits—drug, liquor, etc., are cured.
PERSONAL INSTRUCTION in Psychratism is here given to students by Prof. Vernon himself. Those who cannot afford the expense of a trip to Rochester should send for Prof. Vernon's FREE 100 PAGE BOOK entitled "Psychic Phenomena of the 20th Century," in which he fully describes the science of Psychratism. **Write for it to-day. It costs you nothing.** He wishes all to profit by his experience and knowledge, and will be glad to start you in the study of this, the grandest of all sciences, by sending you the book **free** and **postpaid** upon receipt of your name. This is a valuable book, not a mere advertising pamphlet, and contains much information and the rudimentary lessons in this interesting and elevating science.
Vernon Academy of Mental Sciences and Sanatorium, 2204 East Ave., Rochester, N. Y.

Perfection Air Mattresses (TRADE MARK) AND CUSHIONS
FOR - CAMP - YACHT - HOME - HOSPITAL.
NON-ABSORBENT, HYGIENIC, ODORLESS.
When deflated can be rolled into small package for storage or transportation.
Send for Illustrated Catalogue with Prices.
Mechanical Fabric Co. PROVIDENCE, R.I.

Sun Proof Paints
are guaranteed to give beauty and protection to a house for five years. Send for the free book of paint knowledge. Liberal inducements to dealers.
PATTON PAINT CO., 227 Lake St., Milwaukee, Wis.

ELECTRIC AUTOMOBILE. — DIRECTIONS, with many illustrations, for making a complete machine from two bicycles are given in SUPPLEMENT No. **1195**. The motor and battery are also treated of in detail. Price 10 cents. For sale by Munn & Co. and all newsdealers.

BICYCLE TIRE REPAIRING.—THE Mending of Single Tube Tires.—A practical article illustrating the method of inserting patches and plugs with pliers and pluggers, together with rubber band plugging and the use of puncture bands. 9 illustrations. Contained in SUPPLEMENT **1102**. Price 10 cents. For sale by Munn & Co. and all newsdealers.

The Typewriter Exchange

1½ Barclay St., NEW YORK
124 La Salle St., CHICAGO
38 Bromfield St., BOSTON
817 Wyandotte St., KANSAS CITY, MO.
209 North 9th St., ST. LOUIS, MO.
432 Diamond St., PITTSBURGH, PA.
3 West Baltimore St., BALTIMORE, MD.
536 California St., SAN FRANCISCO, CAL.
We will save you from 10 to 50% on Typewriters of all makes. *Send for Catalogue.*

$5.85 Im. 17 JEWELED

adjusted, patent regulator, stem wind and stem set, genuine NATIONAL SPECIAL movement. Ladies' or Gents' size. WARRANTED 20 YEARS. 14K. Gold plate hunting case, elegantly engraved. Fit for a king. No better watch made. Must be seen to be appreciated. Special offer for next 60 days, send your full name and address and we will send this watch C.O.D. with privilege to examine. If found satisfactory pay agent $5.85 & express charges. A guarantee and beautiful chain & charm sent free with every watch. Write at once as this may not appear again. NAT'L MFG. & IMPORTING CO. 334 Dearborn St., B 420, Chicago, Ill.

? ? ? What Do You Want To Buy?
We can tell you where to buy anything you want.
Write us for the addresses of manufacturers in ANY line of business.
Novelties, Special Tools, Machinery, Equipments, New Patent LABOR SAVING DEVICES.
MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, 361 BROADWAY, NEW YORK.

© 1901 SCIENTIFIC AMERICAN, INC.

The Search for Work

The man who can do something better than anyone else doesn't search for work. Employers search for him. We teach the theory of engineering and the trades to men already at work. Thousands of our students have secured a

Salary-Raising Education

in Mechanical, Electrical, Steam, Civil or Mining Engineering, Chemistry; Architecture; Plumbing; English Branches.

When writing state subject in which interested.

International Correspondence Schools, Box 942, Scranton, Pa.

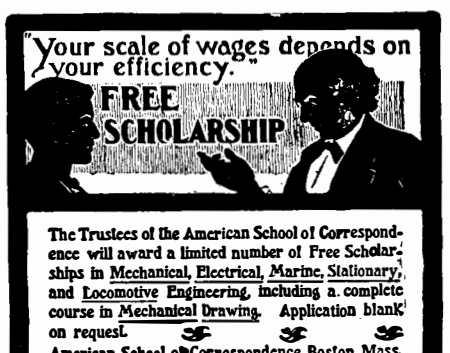
ELECTRICAL ENGINEERING TAUGHT BY MAIL.

Write for our Free Illustrated Book.

"CAN I BECOME AN ELECTRICAL ENGINEER?"

We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Steam Engineering, Mechanical Drawing, at your home by mail. Institute indorsed by Thos. A. Edison and others.

ELECTRICAL ENGINEER INSTITUTE, Dept. A, 240-242 W. 25d St., New York.



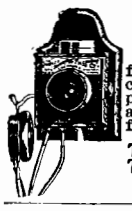
The Trustees of the American School of Correspondence will award a limited number of Free Scholarships in Mechanical, Electrical, Marine, Stationary, and Locomotive Engineering, including a complete course in Mechanical Drawing. Application blank on request.

American School of Correspondence, Boston, Mass. (Chartered by the Commonwealth of Massachusetts.) Mention this paper.

ARTESIAN

Wells, Oil and Gas Wells drilled by contract to any depth from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 1200 feet. Write us stating exactly what is required and send for illustrated catalogue. Address

PIERCE WELL ENGINEERING AND SUPPLY CO. 136 LIBERTY STREET, NEW YORK, U. S. A.



Telephones,

for Interior, Short Line, Intercommunicating and Hotel Work. Write us for prices, catalogue, etc., with testimonials and references. Estimates cheerfully furnished. Agents wanted.

THE SIMPLEX INTERIOR TELEPHONE CO., 431 Main St., Cincinnati, Ohio.

OIL AND SMELTER!

The Union Consolidated Oil Co.

with over 17,000 acres of valuable proven oil lands, and a monthly production of 3,400 barrels.

Equivalent to Over 2% Monthly

on the entire amount invested in its stock; the

Standard Smelting & Refining Co.

with its plant of 250 tons capacity now under active construction in Yavapai County, Ariz., to be completed and in operation in August, promise larger dividends and immediate profits than any mining or industrial investment now before the public. We are Fiscal Agents for 8 mining companies, of which

4 Are Paying Regular Monthly Dividends.

The Union Consolidated Oil Company will begin dividends in May, and The Standard Smelting & Refining Company, as soon as its plant is in operation in August; the other two rapidly approaching a dividend-paying basis. A limited amount of the stock of the former Company is offered at 17½ cents per share and of the latter Company at 40 cents per share, both full paid and non-assessable; or the two

In Combination at 55 Cents Per Share.

Prospectus of each Company, latest reports, subscription blanks and full particulars on application.

DOUGLAS, LACEY & CO.,

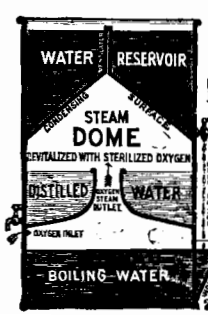
BANKERS AND BROKERS,

Members New York Consolidated Stock Exchange.

66 Broadway and 17 New St., New York.

BRANCHES:

Cleveland, "The Cuyahoga" Building.
Boston, "The International Trust Co." Building.
Philadelphia, "The Betz" Building.
Chicago, "The Fisher" Building.
St. Louis, "The Security" Building.
Kansas City, "The Heist" Building.
Hartford, Conn., "Hill's Block."
New Haven, Conn., "First Nat. Bank" Bldg.
Cincinnati, "The Union Trust" Building.
St. John, N. B., "The McLaughlin" Buildings.
Montreal, Can., "The Temple" Building.
London, Eng., "The Trafalgar" Buildings.



SALESMEN AND AGENTS WANTED

BIG WAGES—Our Famous Puritan Water Still, a wonderful invention—not a filter. 22,000 already sold. Demand enormous. Everybody buys. Over the kitchen stove it furnishes plenty of distilled, aerated drinking water, pure, delicious and safe. Only method. Distilled Water cures Dyspepsia, Stomach, Bowel, Kidney, Bladder and Heart Troubles; prevents fevers and sickness. Write for Booklet, New Plan, Terms, etc. FREE

Harrison Mfg. Co., 297 Harrison Bldg., Cincinnati, O.

Wheel, S. C. Sams	671,778
Wheels, clutch for motor, J. A. Stone	671,737
Wheels to axle arms, means for securing vehicle, R. D. Seibert	671,869
Window, W. C. Taylor	671,642
Window screen, Hipolito & Mastin	671,727
Window screen, J. B. Simmons	671,840
Window ventilator, H. W. Otto	671,654
Wool, softening, Florin & Lagache	671,760
Woven fabric, H. W. Smith	671,497
Wrapping machine, Forbes & Grover	671,761
Wrench, C. Borgeson	671,789

DESIGNS.

Belt, I. Lewenthal	34,357
Bit frame, P. A. McSwain	34,345
Book support, C. D. Daniels	34,353
Cigar, J. Requard	34,334
Compass card, W. L. Marble	34,336
Egg separator or lemon squeezer, L. W. Brown	34,342
Fabric, M. M. Hall	34,358
Hedge trimming knife, W. A. Holland	34,343
Hoof cutter jaw member, T. Barons	34,344
Hook, singletree, L. & F. Roehlk	34,351
Ingot, N. Lodor	34,346
Lace fastener, shoe, Koch & Bloom	34,355
Lacing, shoe, H. L. Hilier	34,356
Mantle holder, Heimann & Henshel	34,352
Paving block, R. D. Culver	34,349
Pencil sharpener and eraser holder, J. D. Stassart	34,335
Register plate, A. W. Ullberg	34,348
Sash holder, S. D. Webb	34,347
Shaft hanger, H. T. Hallowell	34,350
Specula, blank for, C. J. Pilling	34,337
Speculum blades and handles, blank for, C. J. Pilling	34,340
Speculum blades, blank for, C. J. Pilling	34,339
Speculum blades, blank for rectal, C. J. Pilling	34,338
Spoon, S. J. Large	34,341
Toy fort, C. B. Miller	34,354

TRADE MARKS

Air compressors, Rand Drill Company	36,228
Bakery products, certain named, National Biscuit Company	36,221
Boots and shoes, Desnoyers Shoe Company, 36,195,	36,196
Buggies and carriages, Columbia Vehicle Company	36,238
Cameras, lenses, and photographic supplies, Imperial Camera and Manufacturing Company	36,190
Cheese, table, Columbian Cheese Company	36,219
Chemical, pharmaceutical, surgical, dietetic, and cosmetic products and preparations, certain named, Ichthyol-Gesellschaft, Cordes, Hermanni & Co. 36,204 to	36,206
Composition of matter, certain named, Brown & Tredway	36,208
Dental burs, Consolidated Dental Manufacturing Company	36,233
Dentifrices, tooth powders, tooth washes, and tooth paste, C. G. Pease 36,209,	36,210
Drinks, mixed, J. E. Cassidy & Son. 36,212 to	36,216
Eye water, Eagle Remedy Company	36,199
Flour, wheat, R. Tellez & Co	36,222
Food, live stock, Columbus Food Company	36,224
Foods, prepared cereal, Battle Creek Pure Food Company	36,223
Garment fastenings, certain named, De Long Hook and Eye Company	36,230
Gelatin, Swampscott Gelatine Company	36,220
Jewelry, certain named, A. Pfeifer	36,193
Lard and other hog products, E. Reeks & Co.	36,225
Laundry machinery, certain named, Lovell Manufacturing Company	36,237
Machinery, certain named, Stanley Manufacturing Company	36,239
Machines and appliances, certain named, F. D. Moses	36,240
Medicinal and surgical instruments and appliances and medicine for use therewith, certain named, H. M. Dunlap	36,207
Medicinal preparation, certain named, J. G. Leonard	36,202
Medicine for colds, influenza, or la grippe, Col-Campo Chemical Company	36,201
Metal, bearing, Frictionless Metal Company	36,232
Metal goods, certain named, Riverside Metal Company	36,231
Mineral water, certain named, T. F. Goode	36,217
Mowers, lawn, Philadelphia Lawn Mower Company	36,241
Paint and primer, liquid, T. W. Stemmler	36,227
Paints and painters' supplies, certain named, Patton Paint Company	36,226
Pharmaceutical paste preparations, John Wyeth & Brother	36,203
Photographic goods, certain named, T. Manly	36,191
Pianos, certain named, A. M. Virgil	36,234
Refrigerators, C. Schmidt	36,235
Remedies for the cure of rheumatism and gout, W. H. Sithens	36,200
Rubber goods, certain named, Parker, Stearns & Sutton 36,197,	36,198
Sheetings and drillings, G. Woolley & Co	36,194
Shoe and leather dressings, Raven Gloss Manufacturing Company	36,211
Silver souvenirs, J. Lesher	36,192
Stationary, certain named, Dennison & Sons	36,189
Stoves, heaters, and burners, Hydrocarbon Burner Company	36,236
Tobacco, certain named, Bloch Brothers Tobacco Company	36,218
Umbrella and parasol runners, Follmer Clogg & Co	36,229

LABELS.

"Aunt Rose's Cough Syrup," for a cough-syrup, R. S. Dembert	8,294
"Bosco," for mantles for incandescent gas lamps, Mutual Incandescent Light Company	8,283
"Creme Dentozone," for a tooth paste, I. M. Adams	8,297
"Dan Patch," for cigars, G. L. Gillett	8,291
"Dr. Victor H. Sachlu's Celebrated French Antiseptic Cones," for a medicine, H. V. Lucas	8,296
"Glenbrook Maryland Rye," for whisky, C. F. Sullivan & Co	8,290
"Havakan," for canned goods, H. W. Peabody & Co	8,288
"La Eminencia," for cigars, Kraus & Co	8,292
"Larkette," for cigars, Schmidt & Co	8,293
"Neo Plastine," for a medicine, H. L. Miller	8,295
"Phipps & Atchison's New Century Sailor Hat," for hats, Phipps & Atchison	8,282
"Pilsener's Pure Malt," for whisky, W. Moise & Co	8,289
"Prize Orchard Brand," for canned goods, H. W. Peabody & Co	8,287
"Standard," for oleomargarin, Illinois Butterine Company	8,286
"The Leader," for mantles for incandescent gas lamps, Mutual Incandescent Light Company	8,284
"The Mutual Bengal Mantle," for mantles for incandescent gas lamps, Mutual Incandescent Light Company	8,285

PRINTS.

"Dog Leads," for dog leads, Bridgeport Chain Company	322

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $45 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

SAVAGE MAGAZINE RIFLE

.303 and 30-30 Caliber.

The Only Hammerless Repeating Rifle. Smokeless Shooter. One Rifle for Large and Small Game. Point Blank Range for Hunting.

The Rifle of the 20th Century

BAKER & HAMILTON, San Francisco and Sacramento, Cal. Pacific Coast Agents.

Write for New Catalogue A.

SAVAGE ARMS CO., UTICA, N. Y., U. S. A.

COMMISSION
NEW EAST RIVER BRIDGE,
CITY OF NEW YORK.

NOTICE TO CONTRACTORS.

April 4, 1901.

Proposals will be received by the Commissioners of the New East River Bridge, at their office, at No. 258 Broadway, in the Borough of Manhattan, in the City of New York, at two o'clock in the afternoon of the 25TH DAY OF APRIL, 1901, endorsed "PROPOSAL FOR CONSTRUCTION OF THE STEEL SUSPENDED STRUCTURE OF THE NEW EAST RIVER BRIDGE," for furnishing the materials for and constructing the steel suspended structure of the New East River Bridge, in accordance with the proposed form of contract and the drawings and specifications therefor. All bids shall be enclosed in sealed envelopes, addressed to Lewis Nixon, President of the Board of Commissioners of the New East River Bridge, and presented to him on that day and at that hour at said office, and such bids will be opened in public meeting by the said Commissioners on that day at two o'clock in the afternoon.

Copies of the specifications and the general drawings for the work, with the proposed forms for the bid, bond and contract, may be obtained, and further information will be given at the office of the Chief Engineer, No. 84 Broadway, Borough of Brooklyn, City of New York, on and after the 8th day of April, 1901.

The Commissioners require that all bidders shall carefully examine the specifications, drawings and proposed form of contract, in order that no question as to their meaning may arise hereafter. It must be distinctly understood that no changes in the quality of the materials or of the workmanship will be allowed, and that the specifications will be adhered to strictly.

The contract is to be completely performed within eight months after the receipt by the Contractor from the Engineer of written notice to begin the erection of the suspended structure.

Bids will be made upon a form provided therefor, and only those bids will be considered which are complete, in proper form, comply with the requirements herein stated, and are offered by parties of known reputation, experience and responsibility.

Each bidder will be required to deposit, with his proposal, in the office of the Commissioners, a certified check for $10,000, payable to the order of Julian D. Fairchild, as Treasurer of the New East River Bridge Commissioners, as security for the execution by him of the contract and the giving of the required bond, if his bid is accepted, within two weeks after notice of the acceptance of his bid.

Bidders are required to state in their estimates, under oath, that such estimate is made without any connection with any other person making a bid or estimate for the same purpose, and that it is in all respects fair, and without collusion or fraud, and also, that no member of the Municipal Assembly, Head of a Department, School Commissioner, Chief of a Bureau, Deputy thereof or Clerk therein, or other public officer, is directly or indirectly interested therein, or in the supplies or work to which it relates, or in any portion of the profits thereof, as principal, surety or otherwise. The estimate must be verified by the oath, in writing, of the party making such estimate, that the several matters therein stated are in all respects true.

The Contractor will be required to give a bond in the sum of $300,000, in the form annexed to the proposed form of contract, with an approved surety company doing business in the City of New York, conditioned for the prompt and faithful performance of the contract and its covenants and the work thereunder.

As by far the greater part of this work can be executed only by bridge establishments of the first class, bids will be received only from such parties as have the requisite plant and facilities. The bidders must be, in the opinion of the Commissioners, fully qualified both by experience and in appliances to execute work of this character and importance according to the highest standard of bridge work at the present time.

The Commissioners reserve the right to reject any and all of the proposals offered, and to accept any bid offered.

LEWIS NIXON,
President.

JAMES D. BELL,
Secretary.

WE TEACH YOU FREE

$5. to $10. PER DAY.

Gold, Silver, Nickel and Metal Plating. At home or traveling, using and selling Prof. Gray's Machines. Plates Watches, Jewelry, Tableware, Bicycles, all metal goods. NO EXPERIENCE. Heavy plate. Modern methods. No toys. We do plating, make outfits, all sizes. Complete, all tools, lathes, materials, etc., ready for work. The Royal, new dipping process, quick and easy. Write today. Pamphlet, samples, etc., FREE. P. GRAY & CO., Plating Works, CINCINNATI, O.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

SHOE Manufacturers' goods or appliances, of merit, manufactured and sold on royalty. Correspondence solicited. Box 2261, Boston, Mass.

SHORTHAND BY MAIL. Pioneer home course *Catalogue and First Lesson Free.* Potts Shorthand College, Box 33, Williamsport, Pa.

½ H. P. GAS ENGINE CASTINGS

Materials and Blue Prints. Write for Catalogue 9. PARSELL & WEED, 129-131 W. 31st Street, New York.

STEEL TYPEWRITER TYPE

TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

SALE IN EUROPE, particularly in France, of patented American Machines and Industrial Apparatus, and of patented American inventions. L. Simon, Civil & Mechanical Engineer, Troyes, France.

Gears and Supplies. **UNION** Experimental. **MODEL WORKS** Catalogs Free. 193 S. Clark St. CHICAGO.

D'AMOUR & LITTLEDALE MACHINE CO.
130 WORTH ST., NEW YORK.
PATTERN AND MODEL MAKERS.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery. E. V. BAILLARD, Fox Bldg., Franklin Square, New York.

PATENTED AND PATENTABLE DEVICES manufactured and introduced. Experimental work of all kinds. Mechanical drawings, samples, models, etc., executed with dispatch and accuracy. I have for sale the best alligator wrench ever invented. L. B. BAKER, Racine, Wis. Reference: Racine banks and business houses or any Commercial Report.

MORAN FLEXIBLE JOINT for Steam, Air or Liquids. Made in all sizes to stand any desired pressure. Moran Flexible Steam Joint Co., Inc'd, 149 East 3d St., LOUISVILLE, KY.

DRIVING A PLEASURE when holding your horse with an IMPERIAL BIT, giving 100 per cent more leverage than any other. Any lady can control the most vicious horse. Positive cure for tongue-lolling. Will prevent side pulling and driving on one line. Sent to any address, postpaid, upon receipt of price. In X C plate or imitation rubber, $1. In fine nickel plate, $2. Imperial Bit and Snap Co., 14th Street, Racine, Wis.

D. L. HOLDEN
14 South Broad St. Philadelphia Pa.
SOLE MANUFACTURER
REGEALED ICE MACHINES
SEE FIRST PAGE SCIENTIFIC AMERICAN SEPT. 2. 1899.

THE PRINCIPAL CHARACTERISTICS

of the Nickel Plate Road which make it the popular line for the traveling public are competent train service, fine roadbed and courteous employés. The Nickel Plate Road is the Short Line between Buffalo and Chicago. The Great Pan-American Exposition this summer will present unusual attractions. The Nickel Plate Road will be in position to accommodate this travel with safety, speed and comfort. Write, wire, 'phone or call on F. J. Moore, General Agent, 291 Main St., Buffalo, N. Y.

EMPIRE GEARLESS TRANSMISSIONS FOR AUTOMOBILES & TRICYCLES
EMPIRE MOTOR WKS, 888 WASHINGTON ST. BUFFALO N.Y.

MOISTENER and SEALER. For moistening and sealing Stamps, Envelopes and Labels. Patents for sale or on royalty. Excellent chance for manufacturer with facilities for introducing a useful device. Address CHAS. L. VOSE, Westerly, R. I.

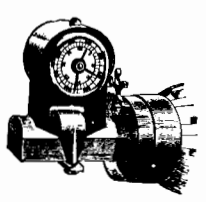
SPECIAL PRICES 30 Days' Trial. Guaranteed. Double and Combination Beam. **OSGOOD SCALE CO.,** 335 Central St., BINGHAMTON, N. Y. Catalog Free. Write now.

ARMATURE WINDING, RIGHT AND Left Handed.—An important paper for all amateurs. 17 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT, No. 1139, price 10 cents. For sale by Munn & Co. and all newsdealers. Send for catalogue.

LYON & HEALY'S Own Make BRASS BAND

INSTRUMENTS. Indorsed by the great Jules Levy as the best in the world. Big Catalog, 400 illustrations, FREE. Positively the lowest prices on Band Instruments, Uniforms and Supplies of all kinds. Also contains Music and Instructions for New Bands. Lyon & Healy, Manufacturers, 38 Adams st., Chicago.

(Lyon & Healy are the largest music house in the world—Editor.)



The.. Improved BELL ODOMETER

APPLIED TO YOUR **AUTOMOBILE** .. OR .. **CARRIAGE**

will give you the exact distance traveled, and announce each mile passed by the stroke of a bell.

Send for Descriptive Circular S.

S. H. DAVIS & CO.

Cor. Portland & Sudbury Sts., Boston, Mass.

THE HARRISON CONVEYOR —Electric Light and Power Station Equipment, Industrial Railways, Overhead Cable Systems, Coal and Ash Conveyors, etc., Eccentric Shaking Screens, Roller Screens, Elevators, Hoisting Engines, Clam Shell Buckets, Breaker Rolls, Picking Tables, Howe Standard Scales, Howe Gas and Gasoline Engines. For catalogue and prices, address the manufacturers.

BORDEN & SELLECK CO., 48-50 LAKE STREET, CHICAGO, ILL.

© 1901 SCIENTIFIC AMERICAN, INC.

FOR MEN OF BRAINS

Cortez CIGARS

—MADE AT KEY WEST—

These Cigars are manufactured under the most favorable climatic conditions and from the mildest blends of Havana tobacco. If we had to pay the imported cigar tax our brands would cost double the money. Send for booklet and particulars.

CORTEZ CIGAR CO., KEY WEST.

THOROUGH INSPECTIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY

STEAM BOILER EXPLOSIONS

J. M. ALLEN, President — W. B. FRANKLIN, Vice President
J. B. PIERCE, Secretary — F. B. ALLEN, 2d Vice President
L. B. BRAINERD, Treas. — L. F. MIDDLEBROOK, Asst Secy

No Difference of Opinion

exists among those who really understand automobiles. For careful construction, beauty, speed, safety, comfort and economy, the

WINTON MOTOR CARRIAGE

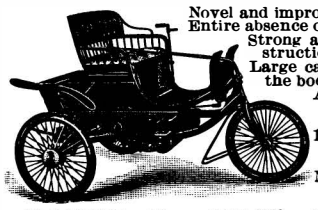
PRICE $1,200.

at once takes front rank. Hydro-carbon (gasoline) system

THE WINTON MOTOR CARRIAGE CO.,
486 Belden Street, Cleveland, Ohio, U. S. A.
EASTERN DEPOT, 150-152 East 58th Street, New York.

KNOX Gasoline Runabout.

WHY SO POPULAR?



Novel and improved engine.
Entire absence of water.
Strong and durable construction.
Large carrying space in the body.
Ample power and all changes of speed.
180 miles on the six gallons of fuel carried.
No experiment. Used in all parts of the country.
Very reliable on account of its extreme simplicity.

Weight 675 Pounds. Price $750.
Immediate Delivery.

KNOX AUTOMOBILE CO., SPRINGFIELD, MASS.

OLIVE BICYCLES

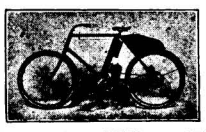
$30.00 to $50.00

MORE ATTRACTIVE THAN EVER.

A liberal proposition offered to the trade.
Write for Art Catalogue.

THE OLIVE WHEEL CO., Syracuse, N. Y.

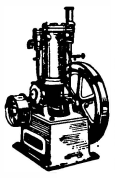
PATEE MOTOR CYCLES $200



Built for business. Sold on a business guaranty. Money back if not satisfactory. No foolishness, no experiment. Orders filled promptly. Don't place an order where you can't get it filled. *WRITE US.*

PATEE BICYCLE CO.
Indianapolis, Ind., U. S. A.

CHARTER ENGINE



USED ANY PLACE BY ANY ONE FOR ANY PURPOSE

FUEL—Gasoline, Gas, Distillate

Stationaries, Portables, Engines and Pumps, Hoisters

☞ State Your Power Needs

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

Computing Figures

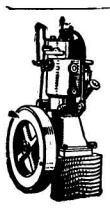
mentally is probably the hardest kind of toil known. The Comptometer makes it easy, is twice as quick, insures accuracy and relieves all mental and nervous strain. Why don't you get one?

Write for Pamphlet.

FELT & TARRANT MFG CO.
52-56 ILLINOIS ST., CHICAGO.

GARDNER GRINDER FOR FLAT SURFACES FOR ACCURATE & RAPID FOR UP-TO-DATE SHOPS

C. H. BESLY & Co. CHICAGO, ILL. U.S.A.



GAS and GASOLINE ENGINES

1-4 and 1 horse power

MARINE and STATIONARY.

Built in accordance with the latest practice in Gas Engine design. Also complete set of castings. Write for particulars.

CLIFTON MOTOR WORKS,
233 E. Clifton Ave., Cincinnati, Ohio.

WALTHAM WATCHES

It is not alone the value of the jewels that makes a first-class watch---it is the brains that have planned its construction. It is mechanical skill and knowledge that have made Waltham Watches the best in the world.

"The Perfected American Watch", an illustrated book of interesting information about watches, will be sent free upon request.

American Waltham Watch Company,
Waltham, Mass.

COMPLETE TOOL LIST

comprising those in use by every trade or profession, with market prices and discounts of same is

Montgomery & Co.'s Tool Catalogue.

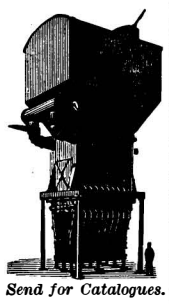
Best book of reference in the world for tools of all kinds. 510 pages, illustrated, pocket size. By mail for 25c.

MONTGOMERY & CO.,
105 Fulton St., New York City.

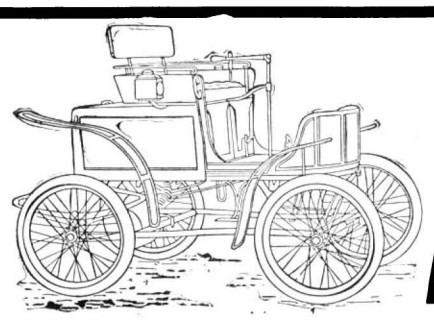
HOT BLAST WATER JACKET FURNACES FOR COPPER ORES.

MATTE from SULPHIDES AT ONE OPERATION.

UNION IRON WORKS,
San Francisco, Cal., U. S. A.



Send for Catalogues.



ELECTRIC RUNABOUT.

Columbia AUTOMOBILES

In Sixth Year of Service.

FORTY MILES ON ONE CHARGE OF BATTERIES.

RELIABILITY. SIMPLICITY. CLEANLINESS.

Where current cannot be conveniently supplied, we are prepared to furnish estimates for, and erect when desired, simple and automatic plants for charging electric vehicles.

Send for 1901 ILLUSTRATED CATALOGUE.

ELECTRIC VEHICLE CO., HARTFORD, CONN.

WATCHES!

No advertisement can properly portray the striking effects produced in our watches. They are illustrated in our

BLUE BOOK showing Ladies' Watches in all metals and exquisite enamels; our

RED BOOK showing Men's and Boys' Watches

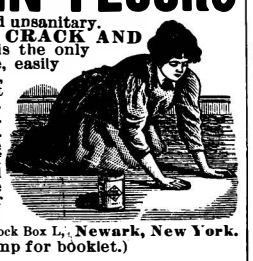
with up-to-date attractive designs.

Either Blue or Red Book sent on application.

THE NEW ENGLAND WATCH CO.,
37 & 39 Maiden Lane, New York City. 149 State Street, Chicago.
Spreckels Building, San Francisco.

CRACKS IN FLOORS

are unsightly, unclean and unsanitary. GRIPPIN'S WOOD, CRACK AND CREVICE FILLER is the only perfect remedy. A Paste, easily applied, elastic, adhesive, and non-shrinkable. Dirt and moth proof. Cost about ½c. per sq. ft. 5 lbs. will treat an average room. Price 20 cts. per lb. State the kind and condition of wood when ordering, and full instructions will be given. Is also the best filler for open-grained woods.



GRIPPIN MFG. CO., Lock Box L, Newark, New York.
(Inclose stamp for booklet.)

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS Ltd 91 JOHN ST. NEW YORK

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

FOR MEN

JAMES MEANS' $2.50 SHOE

(Trade Mark)

None genuine unless bearing upon the heel the adhesive label of which a fac-simile is here given.

James Means' $2.50 Shoe Lic. No. A23450.001

KNOWN AND APPROVED BY THE PUBLIC FOR 23 YEARS.

SOLD BY LEADING RETAILERS.

Made in a variety of styles and leathers. Sewed. Smooth innersoles.

Made in two weights indicated by (L) or (H) stamped upon the soles. Be sure to buy the weight best suited to your needs.

Distributed at wholesale by

MORSE & ROGERS OF NEW YORK.

We prefer to have you buy of your retailer, but if he cannot supply you, we will send single pairs, carriage prepaid, to any point in the United States on receipt of $2.75. Mention your size, width and the style desired.

MORROW COASTER BRAKE.

FITS ANY CYCLE. 100,000 IN USE

ADDS PLEASURE AND SAFETY—ALL DEALERS SELL THEM.

RIDE 50 MILES—PEDAL ONLY 35 SEND FOR BOOKLET.

ECLIPSE MANUFACTURING Co., BOX X, ELMIRA, N.Y.

Williams' Shaving Stick

Famous for its Big-Thick Creamy Lather.

"The Only Kind that Won't Dry on the Face"

SOLD EVERYWHERE.
Williams' Shaving Stick, 25c.
Genuine Yankee Shaving Soap, 10c.
Luxury Shaving Tablet, 25c.
Swiss Violet Shaving Cream, 50c.
Williams' Shaving Soap (Barbers'), 6 Round Cakes, 1 lb., 40c. Exquisite also for toilet. Trial cake for 2c. stamp.
The only firm in the world making a specialty of SHAVING Soaps.

THE J. B. WILLIAMS CO., Glastonbury, Ct.
LONDON PARIS DRESDEN SYDNEY

The NATIONAL

EXCELLENCE ELEGANCE

ROAD WAGON—Style D—$1,500.

National Automobiles are always ready to run, do not "freeze up" in winter or roast you in summer, have no unpleasant odor, do not leave a trail of blinding vapor and are noiseless.

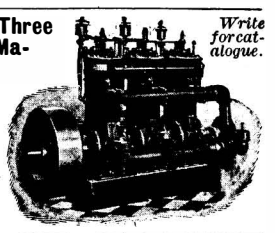
To appreciate **The National** you should own one of "the other kind" first, but as you can't do this send us ten cents in stamps for our "Auto Book." If you contemplate purchasing an Automobile, this will be the best ten cent investment you ever made.

Illustrated pamphlet mailed free to any address

The National Automobile & Electric Co.
INDIANAPOLIS, IND.
1115 EAST 22d STREET.

The "Wolverine" Three Cylinder Gasoline Marine Engine.

Write for catalogue.



The only reversing and self-starting gasoline engine on the market. Lightest engine for the power built. Practically no vibration. Absolutely safe. Single, double and triple marine and stationary motors from ¾ to 30 H. P.

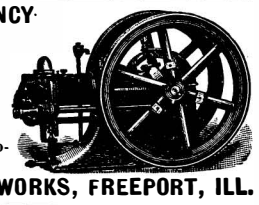
WOLVERINE MOTOR WORKS,
Grand Rapids, Mich.

ACETYLENE

DO YOU KNOW that the most light, least trouble, greatest comfort can be secured by using good burners. The best burner is D. M. STEWARD'S WONDER. Write, inclosing 25 cents, for sample.
STATE LINE MFG. CO., Chattanooga, Tenn., U. S. A.

HIGHEST EFFICIENCY attained in the

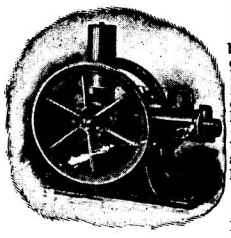
STOVER GASOLINE ENGINE



The best is always cheapest. *Write for prices.*

STOVER ENGINE WORKS, FREEPORT, ILL.

THE MIETZ & WEISS **KEROSENE and GAS Engine**



burns KEROSENE cheaper and safer than gasoline. Automatic, simple, reliable. No electric battery or flame used. Perfect regulation. Belted or directly coupled to dynamo for electric lighting, charging storage batteries and all power purposes.

☞ Send for Catalogue.

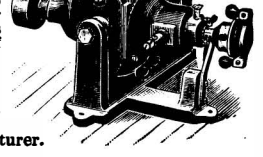
A. MIETZ,
128-138 Mott St., New York.
Markt&Co., London, Hamburg, Paris

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or by any bookseller or newsdealer.

The AUTOSPARKER

The completion of the Gas Engine.

Throw away your batteries and use them no more. The Autosparker saves its cost many times over during the life of your engine. Address



MOTSINGER DEVICE M'F'G CO.,
Pendleton, Ind., U. S. A.
or any gas engine or motor carriage manufacturer.

© 1901 SCIENTIFIC AMERICAN, INC.